(2)

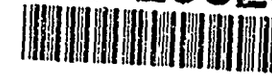
IDA PAPER P-2611

A SIMULATION-BASED INTENSIFIED TRAINING READINESS STRATEGY FOR THE RESERVE COMPONENT

Frederic J. Brown, Ph.D.
Lieutenant General, USA (Retired)

December 1991

Prepared for
Defense Advanced Research Projects Agency



INSTITUTE FOR DEFENSE ANALYSES
1801 N. Beauregard Street, Alexandria, Virginia 22311-1772

IDA Log No. HQ 91-387

IDA PAPER P-2611

A SIMULATION-BASED INTENSIFIED TRAINING READINESS STRATEGY FOR THE RESERVE COMPONENT

Frederic J. Brown, Ph.D.
Lieutenant General, USA (Retired)

December 1991

Prepared for
Defense Advanced Research Projects Agency

INSTITUTE FOR DEFENSE ANALYSES
1801 N. Beauregard Street, Alexandria, Virginia 22311-1772

IDA Log No. HQ 91-38771

DEFINITIONS

IDA publishes the following documents to report the results of its work.

Reports

Reports are the most authoritative and most carefully considered products IDA publishes. They normally embody results of major projects which (a) have a direct bearing on decisions affecting major programs, (b) address issues of significant concern to the Executive Branch, the Congress and/or the public, or (c) address issues that have significant economic implications. IDA Reports are reviewed by outside panels of experts to ensure their high quality and relevance to the problems studied, and they are released by the President of IDA.

Group Reports

Group Reports record the findings and results of IDA established working groups and panels composed of senior individuals addressing major issues which otherwise would be the subject of an IDA Report. IDA Group Reports are reviewed by the senior individuals responsible for the project and others as selected by IDA to ensure their high quality and relevance to the problems studied, and are released by the President of IDA.

Papers

Papers, also authoritative and carefully considered products of IDA, address studies that are narrower in scope than those covered in Reports. IDA Papers are reviewed to ensure that they meet the high standards expected of refereed papers in professional journals or formal Agency reports.

Documents

IDA Documents are used for the convenience of the sponsors or the analysts (a) to record substantive work done in quick reaction studies, (b) to record the proceedings of conferences and meetings, (c) to make available preliminary and tentative results of analyses, (d) to record data developed in the course of an investigation, or (e) to forward information that is essentially unanalyzed and unevaluated. The review of IDA Documents is suited to their content and intended use.

The work reported in this document was conducted under contract MDA 903 89 C 0003 for the Department of Defense. The publication of this IDA document does not indicate endorsement by the Department of Defense, nor should the contents be construed as reflecting the official position of that Agency.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	December 1991	Final--March 1991-September 1991

4. TITLE AND SUBTITLE

A Simulation-Based Intensified Training Readiness Strategy for the Reserve Component

5. FUNDING NUMBERS

C - MDA 903 89 C 0003

T - A-132

6. AUTHOR(S)

Frederic J. Brown

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Institute for Defense Analyses
1801 N. Beauregard St.
Alexandria, VA 22311-1772

8. PERFORMING ORGANIZATION REPORT NUMBER

IDA Paper P-2611

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Defense Advanced Research Projects Agency
3701 N. Fairfax Drive
Arlington, VA 22204-1714

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

Drawing on emerging simulation technologies, this paper proposes general policies and programs to improve significantly both effectiveness and efficiency of Reserve Component training. It focuses on combat armor units of the National Guard. The study develops an objective intensive training strategy for 1998. It then describes both training and technology developments required to enable the strategy. Proposed concepts are applied to small unit and leader training. Four general leverage areas are described: Compression, Distribution, Modernization, and Prioritization. The strategy then defines six specific developments to intensify National Guard training. Five DARPA/NGB Technology Teams are proposed to meld technology development with field unit needs. An action plan is proposed recommending both a planned development schedule and extensive evaluation tied together in a joint NGB-DARPA program. The paper establishes a model for the application of improved simulation to combat support and combat service support units and battle command staff training.

14. SUBJECT TERMS

Reserve Components, Training, Simulation/Simulators, National Guard, Unit Training, Training Strategy

15. NUMBER OF PAGES

187

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	SAR

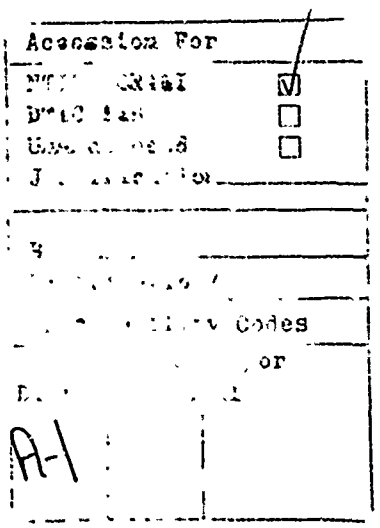
IDA PAPER P-2611

A SIMULATION-BASED INTENSIFIED TRAINING READINESS STRATEGY FOR THE RESERVE COMPONENT

Frederic J. Brown
Lieutenant General, USA (Retired)

December 1991

INSTITUTE FOR DEFENSE ANALYSES
Contract MDA 903 89 C 0003
DARPA Assignment A-132



PREFACE

This Paper was prepared by IDA as part of its work on Advanced Distributed Simulation Technology for the Defense Advanced Research Projects Agency.

This Paper defines an intensive training strategy for the Reserves in 1998. It describes both training and technology developments required to achieve significant improvements in readiness using emerging tactical engagement simulations in a proposed DARPA/NGB program.

The author thanks Dr. Earl A. Alluisi, General (Retired) Paul F. Gorman, Dr. Howard McFann, Dr. Jesse Orlansky, and Dr. Edwin S. Townsley for their helpful reviews of this paper.

ABSTRACT

Drawing on emerging simulation technologies, this paper proposes general policies and programs to improve significantly both effectiveness and efficiency of Reserve Component training. It focuses on combat armor units of the National Guard. The study develops an objective intensive training strategy for 1998. It then describes both training and technology developments required to enable the strategy. Proposed concepts are applied to small unit and leader training. Four general leverage areas are described: Compression, Distribution, Modernization, and Prioritization. The strategy then defines six specific developments to intensify National Guard training. Five DARPA/NGB Technology Teams are proposed to meld technology development with field unit needs. An action plan is proposed recommending both a planned development schedule and extensive evaluation tied together in a joint NGB-DARPA program. The paper establishes a model for the application of improved simulation to combat support and combat service support units and to battle command staff training.

CONTENTS

Preface iii

Abstract v

Enclosures x

Figures xi

Abbreviations xiii

Executive Summary S-1

I. DEFINING THE REQUIREMENT I-1

A. General Guidance I-1

B. New Opportunities I-7

C. Organization of the Development Effort I-9

II. CONCEPTS FOR RC TRAINING II-1

A. Compression II-3

B. Distribution II-4

C. Modernization II-5

D. Prioritization II-5

E. Compression II-7

1. Immersion in Warfighting II-7
2. Train in Unit Context With Complementarity of Training on Actual Equipment and in Simulation II-9
3. Shift in Loci of Training II-10
4. Train the Unit to Train (Decentralized) While Training its Leaders (Centralized) in the School II-11
5. Encourage Local "What Ifs" II-13
6. Chain of Command Not Observer/Controller Training II-14
7. Use Drills and Tables to Train Basics II-16
8. Design Training to Encourage Competition II-18
9. Encourage Supportive Unit Policies II-19

F. Distribution II-20

1. Distribute Training to the Lowest Feasible Echelon II-20
2. Incorporate Low Cost Consumer Electronics II-22

G. Modernization II-23
1. Develop Flexibility of Echelon, Locale, Means and Applications II-23
2. Improve the Resolution of Virtual Realities II-25
3. Provide Improved Networked Simulators (Freestanding and Appended to Actual Equipment) II-27
4. Create New Training Exercises II-28

H. Prioritization II-29
1. Train "Levering" Battle Tasks II-29
2. Institutional Training Priority for Leader Training II-30

III. DESIGN OF SMALL UNIT TRAINING III-1

A. Scope III-1

B. Development Foci III-3
1. Compression III-4
2. Distribution III-10
3. Modernization III-12
4. Prioritization III-15

IV. DESIGN OF LEADER TRAINING IV-1

A. Scope IV-1

B. Development Foci IV-2
1. Compression IV-4
2. Distribution IV-14
3. Modernization IV-17
4. Prioritization IV-23

V. EXECUTING THE VISION V-1

A. Commander-Staff Trainer V-2
1. Concept V-2
2. Application V-3
3. Evaluation V-3

B. New Training Exercises V-3
1. Concept V-3
2. Application V-4
3. Evaluation V-4

C. Structured Training Programs V-4
1. Concept V-4
2. Application V-5
3. Evaluation V-5

D. Distributed Training V-5
1. Concept V-5
2. Application V-6
3. Evaluation V-6

E. Abrams Simulator/Simulation (Abrams/Trainer-Bradley Trainer) V-6
1. Concept V-6
2. Applications V-7
3. Evaluation V-7

F. Instrumented Abrams/Bradley V-7
1. Concept V-7
2. Applications V-8
3. Evaluation V-8

G. Summary V-8

VI. TECHNOLOGY IMPERATIVES VI-1

A. Technology Team: New Generation of Simulation/Simulators VI-4
1. Relevant Guard Program Area VI-4
2. Relevant DARPA Requirement Development Tasks VI-4
3. Conceptual Guidance VI-4
4. Milestones VI-5
5. Trials VI-5

B. Technology Team: Instrumentation of Operational Equipment VI-5
1. Relevant Guard Program Area VI-5
2. Relevant DARPA Requirement Development Tasks VI-5
3. Conceptual Guidance VI-6
4. Milestones VI-6
5. Trials VI-6

C. Technology Team: Expanded Behavior Representation VI-6
1. Relevant Guard Program Area VI-6
2. Relevant DARPA Requirement Development Tasks VI-7
3. Conceptual Guidance VI-7
4. Milestones VI-7
5. Trials VI-8

D. Technology Team: Soldier Networking VI-8
1. Relevant Guard Program Area VI-8
2. Relevant DARPA Requirement Development Tasks VI-8
3. Conceptual Guidance VI-8
4. Milestones VI-8
5. Trials VI-9

E. Technology Team: Quick Response Graphics VI-9
1. Relevant Guard Program Area VI-9
2. Relevant DARPA Requirement Development Tasks VI-9
3. Conceptual Guidance VI-10
4. Milestones VI-10
5. Trials VI-10

VII. DISCUSSION VII-1

A. Assumptions VII-1

B. Qualifications VII-3

C. Insights--Implied Tasks VII-3

D. Summary VII-7

VIII. CONCLUSIONS AND RECOMMENDATIONS VIII-1

A. Conclusions VIII-1

B. Recommendations VIII-4

ENCLOSURES

A. TACTICAL TABLES A-1

B. BATTLE COMMAND/STAFF TABLES B-1

C. STRUCTURED TRAINING C-1

D. EVALUATION D-1

E. POST MOBILIZATION TRAINING E-1

F. ABSTRACT FROM IDA STATEMENT OF WORK F-1

FIGURES

1. Unit Strategy Formulation Guidelines.....I-4

2. A New Paradigm.....I-8

3. Summary of Requirements V-10

4. RC Training and Technology Development Schedule of "Trials"--
Proofs of Principle and Training Effectiveness Analyses..... V-11

5. DoD Applications of Simulation VI-2

6. Requirements Development.....VI-3

ABBREVIATIONS

AAR	After Action Review
ABC	Air Battle Commander
ABS	Advanced Battle Simulation
AC	Active Component
ACR	Armored Cavalry Regiment
ADA	U.S. Army Air Defense Artillery
AFV	Armored Fighting Vehicle
ALO	Air Liaison Officer USAF
ALOC	Air Lines of Communication
ANCOC-RC	Advanced Non Commissioned Officer Course-Reserve Component
AOAC	Armor Officer Advanced Course
AOBC	Armor Officer Basic Course
AR	Armor
ARI	Army Research Institute
ARTBASS	Army Training Battle Simulation System
ARTEP	Army Training and Evaluation Program
AT	Annual Training
BCTP	Battle Command Training Program
BDA	Battle Damage Assessment
Bde	Brigade
BOS	Battlefield Operating Systems
Bn	Battalion
BNCOC-RC	Basic Non Commissioned Officer Course-Reserve Component
BP	basic pay
BTMS	Battalion Training Management System
CALFEX	Combined Arms Live Fire Exercise
CAPSTONE	U.S. Forces command program to align Reserve and Active units to their wartime contingency chain of command

CAS	Close Air Support
CATS	Combined Arms Training Strategy
CATT	Combined Arms Tactical Trainer
CCTT	Close Combat Tactical Trainer
CFX	Command Field Exercise
CINC	Commander in Chief
CINCFOR	Commander in Chief U.S. Forces Command
CIS	Combat Instruction Sets
CMF	Career Management Field
CMTC	Combat Maneuver Training Center
Co	Company
COFT	Conduct of Fire Trainer
COHORT	Cohesion, Operational Readiness and Training
CO/TM	Company/Team
CPX	Command Post Exercise
CS	Combat Support
CSS	Combat Service Support
CTC	Combat Training Centers
DAG	Division Artillery Group
DARPA	Defense Advanced Research Projects Agency
DIV	Division
DS	Direct Support
EA CAT	Engagement Area CAT
ENDEX	End of Exercise
ETL	Essential Task List
EW	Electronic Warfare
FASCAM	Family of Scatterable Mines
FCX	Fire Coordination Exercise
FIST	Fire Support Team
FORSCOM	United States Forces Command
FRAGO	Fragmentary Order
FW	Fixed Wing

HMMWV	High Mobility Multipurpose Wheeled Vehicle
IDA	Institute for Defense Analyses
IDT	Inactive Duty Training
IEW	Intelligence, Electronic Warfare
JAAT	Joint Air Attack Team
JESS	Joint Exercise Simulation System
JRTC	Joint Readiness Training Center
LCX	Logistics Coordination Exercise
LTA	Local Training Area
MATES	Maintenance and Equipment Site
METL	Mission Essential Task List
METT-T	Mission, Enemy Troops, Terrain and Time Available
MILES	Multiple Integrated Laser System
MOE	Measure of Effectiveness
MOP	Measure of Performance
MPRC	Multipurpose Range Complex
MQS	Military Qualification Standard
MRB	Motorized Rifle Battalion
MRC	Motorized Rifle company
MRR	Motorized Rifle Regiment
M SIMNET	Mobile SIMNET
MTA	Major Training Area
MTP	Mission Training Plan
MUTA	Multiple Unit Training Assembly
NCO	Non-Commissioned Officer
NCOES	Non-Commissioned Officers' Education System
NG	National Guard
NTC	National Training Center

OAC-RC	Officer Advanced Course-Reserve Component
OAC	Officer Advanced Course
OBC	Officer Basic Course
O/C	Observer/Controller
OPCON	Operational Control
OPFOR	Opposition Force
OPORD	Operations Order
OPSCHED	Operations Schedule
OPTEMPO	Operating Tempo
ORLL	Operational Reports Lessons Learned
PL	Phase Line
PLT	Platoon
POI	Program of Instruction
POP	Proof of Principle
PVD	Plan View Display
RAG	Regimental Artillery Group
RC	Reserve Component
RC BTC	Reserve Component Battalion Training Center
RCTCC	Reserve Component Tank Commander Course
RTC	Regional Training Center
RW	Rotary Wing
SAFOR	Semi-Automated Force
SC	Speciality Code
SEAD	Suppression of Air Defense
SIB	Special Investigations Branch
SIMNET	Simulation Networking
SIMNET T	Training
SIMNET D	Development
STAFFEX	Staff Exercise
STX	Situational Training Exercises

TADSS	Training Aids, Devices, Simulators, and Simulations
TC	Tank Commander
TEA	Training Effectiveness Analysis (es)
TEO	Training Evaluation Outline
TES	Tactical Engagement Simulation
constructive TES (JESS)	
subsistent TES (MILES)	
virtual TES (SIMNET)	
TEWT	Tactical Exercise Without Troops
TF	Task Force
TLP	Troop Leading Procedure
TOC	Tactical Operating Center
TOE	Table of Organization and Equipment
TOW	Tube-Launched, Optically Tracked, Wire-Guided Antitank Missile
TR	Training Reserve
TRADOC	U.S. Army Training and Doctrine Command
TRP	Troop
UCOFT	Unit Conduct of Fire Trainer
UMCP	Unit Maintenance Collection Point
UTA	Unit Training Assembly
WAREX	Warfighting Exercise
WET	Weekend Equipment Training
WIA	Wounded in Action
XO	Executive Officer

EXECUTIVE SUMMARY

The objective of this study is to develop and design a new simulation-based intensified training readiness strategy for the Reserve Component. The strategy intends to create an order-of-magnitude improvement in the effectiveness and efficiency of Reserve Forces training. Measures of success were postulated to be the ability to compress one week of pre-mobilization summer training into one weekend, or 60 days of post-mobilization training into 15 to 30 days, both by 1998. The scope of the study was limited to one application, U.S. Army National Guard armor units, Company and below, the most challenging reserve readiness training issue of Desert Shield. Use of time--the critical resource for reserves--is discussed in detail. Dollar and manpower costs are not defined, although both are focused to enable extensive training distributed to small unit armories.

A progressive program is proposed to address the twin enabling challenges of developing new training and new technology applications. The program parts are:

- Identifying and focusing four areas of significant potential leverage;
- Establishing conceptual direction for design and development of both training and technology;
- Recommending several practical development programs for Guard leadership; and
- Suggesting management techniques to blend soldier need and scientific research. These techniques include both organizational teams and an intensive evaluation effort.

There are four areas of significant leverage. *Compression* of the time required to train to proficiency is a challenge of training development by the Guard teamed with the TRADOC branch proponent. Existing training exercises are excellent but they need to be supplemented by the establishment of new more intense exercises merged into structured training programs. *Distribution* of training should permit the shift of most training to the local unit if not to the home of the citizen soldier with full netting throughout the chain of command. *Modernization* of training support should permit much more effective training support highly flexible to varying requirements of the small unit commander and leader. Both distribution and modernization involve development of new technologies. Finally,

Prioritization of training requirements is necessary to focus the training on a reduced number of high priority individual and collective tasks.

The next step is identification of the conceptual direction required to guide detailed development of both training and technology in support of the leverage areas above. Seventeen decision rules for the developer are proposed. This guidance is then expanded for use by training and technology developers by relating the general concept to small unit and leader training in institution and unit in turn. This guidance should be sufficiently explicit to direct the initial development effort but it will not suffice to get a tangible product out for soldier and leader assessment.

To produce tangible products, a soldier-oriented action program is proposed to focus integrated development and subsequent evaluation across the National Guard. Six levering program areas were selected and an appropriate development schedule laid out. In addition, a tentative schedule for confirming "trials" was described to orchestrate the very considerable training development required from the uniformed military--both Guard and TRADOC proponents. The program areas are:

- Commander-Staff Trainer
- Distributed Training
- Structured Training Programs
- New Training Exercises
- Abrams/Bradley Trainers
- Instrumented Abrams/Bradley.

Representing a combination of training development (New Training Exercises and Structured Training Programs) and hardware training support, these projects should by their nature encourage frequent field trials with citizen soldiers to ensure that the necessary intensification of training is in fact taking place. These projects need to be directed by the Guard both in detailed design and in repetitive evaluation to ensure that the product trains as desired on a distributed basis.

Technology needs developed in this study are then related to current DARPA Requirements Development Tasks and five integrating technology teams were proposed composed of DARPA/NGB program management, Guard soldiers and scientists. The five teams focus on: a new generation of simulation/simulators; low cost improved resolution; instrumentation of equipment; expanded behavior representation; soldier networking and quick response graphics.

These development areas need to be stressed by an extensive evaluation program consisting of frequent Proofs of Principle and Training Effectiveness Analyses during the

period FY 1993-1997. Planning in these areas should begin as soon as possible and pacing trials should start within months in association with FORSCOM Project Bold Shift. A tentative listing of trials is included. The development model should be successful for Guard combat units despite known uncertainties of high risk development--the traditional DARPA challenge. Combat service and combat service support training development should follow as should translation to other Services.

The study recommends that National Guard and DARPA:

1. Approve the model and conceptual direction above for execution as the simulation-based intensified training readiness strategy.
2. Develop a DARPA/NG action program to implement the training readiness strategy.
3. Establish development teams to complete the detailed planning required for the initial programs proposed in Chapter V. Initiate selected start-up actions in association with FORSCOM Bold Shift.
4. Initiate a separate effort to complete development of battle/command staff training to Battalion and Brigade levels and to develop training support required for combat support and combat service support training. This development should be compatible with light forces, Special Operating Force and USMC use.

I. DEFINING THE REQUIREMENT

The objective is to ". . . develop and design a new simulation-based intensified training readiness strategy for the Reserve Component intended to create an order of magnitude improvement in the effectiveness and efficiency of Reserve Forces training."

IDA Statement of Work,
28 March 1991

A. GENERAL GUIDANCE

The Total Force shines in the afterglow of Operation Desert Shield. A decisive military victory against a major regional power was achieved with the critical participation of highly competent reserve forces across the range of military capability. Although the participation was essential for all the Services, the greatest participation was in support of land forces. The Army alone called up 1,040 units, some 140,000 soldiers who provided essential capabilities not otherwise available on three continents. Almost 700 units (73,000 soldiers) went to the Gulf; 41 units (9,500 soldiers) reinforced Europe; and 297 units (42,000 soldiers) reinforced the training and support base in the United States. This valuable contribution continues through the year in the aftermath of war. Recently called ". . . the most successful mobilization in the history of the Total Army" by the Army Chief of Staff at the Annual Association of the United States Army meeting, it seems clear that United States reserve forces have fully established their credibility in the eyes of the American people.

The importance of reserve forces has been reaffirmed in the new national security policy which mandates an approach:

> . . . to maintain a Total Force appropriate for the strategic and fiscal demands of a new era: a smaller, more self contained and very ready active force able to respond quickly to emerging threats; and a reduced but still essential reserve component with emphasis on supporting and sustaining active combat forces, and--in particularly large or prolonged regional contingencies--providing latent combat capability that can be made ready when needed.

National Security Strategy of the United States,
August, 1991, p. 29.

This is reinforced in the *National Military Strategy*:

> For large or protracted crises, we will increasingly rely upon the reserve components as well as force reconstitution, if needed.
>
> *National Military Strategy for the 1990s (Draft)*,
> August 22, 1991, p. 11.

The Army's recent concept for the emergent warfighting doctrine, Airland Operations, is even more explicit:

> During future operations, a significant portion of the committed force will probably come from the RC. . . .
>
> TRADOC Pam 525-5. *Airland Operations*,
> 1 August 1991, p. 10.

Desert Storm success accelerates reliance on reserves as the nation contemplates the emerging post cold war period. Forward Presence forces are being drawn down and Power Projection capability reduced--both the rapidly deployable and the reinforcement forces. Although the final decisions are yet to be made, it is apparent that reinforcement and reconstitution forces will be largely reserve, as is the case with most of our Allies. As requirements for varying levels of reserve force readiness become evident for all the Services, the training challenge comes to the fore as noted by the recent DoD Total Force Policy Study:

> **Training.** U.S. military personnel, whether active or reserve, must be well-trained and capable of responding to threats to the nation's security interests. It is neither necessary nor cost-effective, however, to maintain all units at the same levels of readiness. Later-deploying reserve units can be maintained at levels of readiness that will ensure their readiness for deployment after a certain amount of post-mobilization training. Limits on the availability of training equipment, ranges, and strategic lift make it prudent to consider this factor in structuring forces.
>
> DoD Total Force Policy Report to the Congress,
> December 1990, p. 31.

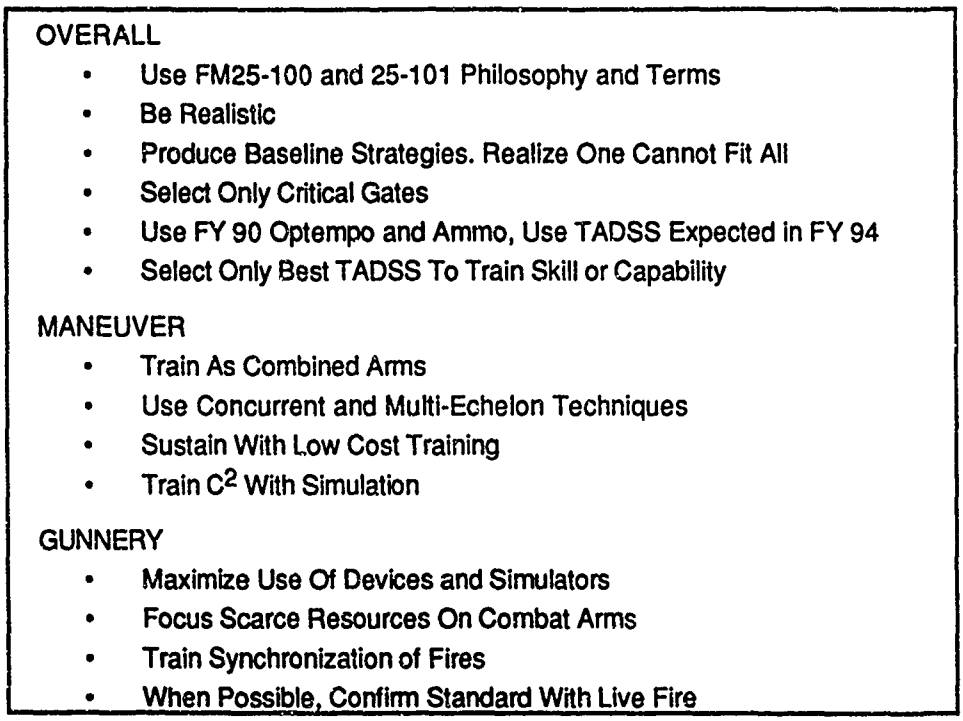
Training potential becomes, in fact, the critical path in influencing major force structure decisions as to the structure and composition of the Total Force. Nowhere is this challenge greater than in landpower, particularly for the Army with the greatest quantitative problem. The training challenge is particularly acute for combat arms forces--the infantry and armor. Looking back at the training challenges of Desert Shield, General Burba,

CINCFOR, highlighted the problem of ground combat unit training readiness, particularly as it affected the three National Guard roundout brigades which were called up:

> Roundout infantry and armor units must become expert at synchronizing complex battlefield systems such as Army aviation, air defense, direct and indirect fire support, command and control, intelligence, engineer, close air support and logistics to fight and survive on the battlefield. Proficiency with these synchronization tasks comes with rigorous, repetitive collective training at company level and above. It should not be surprising that combat maneuver roundout units require significantly more post-mobilization training than combat support and combat service support units. The complex and unforgiving nature of these tasks and difficulty in training them during weekend drill periods pose a difficult challenge to roundout combat units.
>
> Burba, HASC Testimony
> 8 March 1991, pp. 7-8.

Development of a simulation-based intensive training strategy for the Reserve Component requires a joint if not combined perspective as we contemplate regional coalition warfare with our allies. The first step is to narrow and more precisely define the problem. Training and technology development can and should be applied across the Services if not with our Allies. For purposes of this study effort, however, the challenge is limited to training of Army combat units which from the evidence of Desert Shield is the most difficult challenge. Clearly, responses for this most difficult case will need to be applied to unique problems of other Services. Applications should appear evident throughout this paper.

Army training requirements are explicit. The doctrine is comprehensive and consistent, representing almost twenty years of concentrated effort. Field Manuals 25-100 and 25-101 define the broad training principles and then relate them specifically to small unit training for combat, combat support, and combat service support. Related specifically to the Army's warfighting doctrine, FM 100-5, these principles must guide any training and technology developments. Policies and programs for day-to-day combat forces training are prescribed in the Army Combined Arms Training Strategy, which acknowledges the need for explicit training strategies stating development guidance (see Fig. 1).



HQ TRADOC Army Combined Arms Training Strategy
12/12/90. Chart 10.

Figure 1. Unit Strategy Formulation Guidelines

These are excellent general rules for design of training strategies but they may not be sufficiently cognizant of unique problems of reserve forces. This concern was evident to the National Guard as it prepared its guidance to implement Army training policy for Guard units, the Integrated Training System.

> CATS began as a strategy which sought to increase device based training and reduce vehicle- (or system-) based training. The ARNG should participate in this effort. . . . Two aspects of CATS should be of concern to the ARNG. First, CATS has evolved from devices required to satisfy training needs in the school house (TRADOC) or on an Active Component (AC) installation. These devices may not satisfy an ARNG unit training requirement or fit the ARNG environment. Second, CATS demands certain operating tempo (OPTEMPO) trade-offs. Less time in the field should equal less spare parts, fuel, oil, and ammunition consumption. In the ARNG, however, this should not be the primary selection criterion for a device. Increased training opportunities which increase unit combat readiness within the 39 days of home station training is the key criterion.
>
> National Guard Bureau, *Integrated Training System*
> February 1991, p. 1.

The Guard Bureau has it exactly right. CATS is not wrong, it is just incomplete in that it does not fully acknowledge unique characteristics of the reserve training environment which influence both desirability and feasibility of policy and program. For example, the Army Guard has some 7,000 Company-level organizations spread across over 4,600 locations. The average dispersion of Battalion-size units is 150 miles with some spread over 300 miles. A large percentage of the annual budget is consumed by transportation costs. These considerations alone portray a training and resourcing environment vastly different from that existing for the active forces. Quite reasonably, the Guard found it necessary to interpret CATS for execution in the average unit. At the same time, it developed purposeful ways to support the guidance of FM 25-100 and 25-101 across unique reserve environments. This study draws on the wisdom of the Integrated Training System.

Generalized doctrine and training systems strongly influence the process of training, but they are not determinant. The mission dominates. The training mission for reserve forces described to Congress by General Burba as CINCFOR is possible in the future, particularly if both effectiveness and efficiency of reserve training can be improved.

> Prior to mobilization, during Inactive Duty Training (IDT), individual and crew level skills must be the centerpiece of the unit's training program. Basic gunnery and preventive maintenance skills should also be honed to a measured level of proficiency to establish a baseline from which the unit can progress to small unit collective skills. During the unit's two-week Annual Training (AT) period, small unit collective skills--platoon and company level maneuvers and gunnery--must be exercised. This begins the difficult synchronization training process that is so critical to the success of combat units on the modern battlefield. Some multi-echelon battalion and brigade training is necessary but not to the hindrance of lower level skills.
>
> Battalion and brigade level commanders and staff training should be focused on simulation training. It must be aggressively pursued so that our leaders can be trained to orchestrate the complex operating systems of today's airland battlefield. This includes attendance at the Tactical Command Development Course and frequent use of battle simulations. Schools for officer and NCO professional development and special qualification training also must be pursued to precipitate technically and tactically proficient, homogenous fighting units.
>
> Burba, HASC Testimony
> 8 March 1991, p. 12-1.

As should be expected, this guidance is reinforced in National Guard Regulation although here there is as much future desirability as immediate feasibility. The difference in

context between the two points up the need to provide greater training support to reserve forces in order to enable this Guard vision.

> The goal of ARNG unit training is to be able to mobilize, deploy, fight and win upon arrival in the gaining CAPSTONE[1] command. The training objective is to "maintain company level proficiency, attain battalion level proficiency, and train to the level organized" (p. 2, FORSCOM/ARNG Regulation 350-2, 1989). The terms "train to the level organized" or "training at the level organized" are interchangeable. They are defined as: (1) training conducted by the highest level organized to standards addressed in doctrinal literature, or (2) by the functional combination of that parent organization's elements when it improves the higher unit's end state capability to fight at that level.
>
> National Guard Bureau, *Integrated Training System* February 1991, p. 2.

The objective of this study is to develop and design a new simulation-based intensified training readiness strategy for the Reserve Component intended to create an order of magnitude improvement in the effectiveness and efficiency of Reserve Forces training. Significant improvement in both efficiency and effectiveness simultaneously is a formidable challenge. Two broad interrelated development paths are pursued--new simulation technology and an intensified training strategy. There are four major tasks implicit in this approach to the development challenge. They are:

(a) Make a major difference, improvements at the margin are insufficient. Novel, innovative approaches are mandated.

(b) Establish an objective intensive training strategy which will enable (a) above.

(c) Develop the necessary training support including new technology and appropriate "Guard-friendly" applications.

(d) Propose an appropriate training management structure to execute the recommended strategy, both organization and evaluation.

An order of magnitude change could be the ability to compress the training benefit of one week of Annual Training today into one weekend of training by 1998. Alternatively, the objective could be to compress sixty days of post mobilization training required today into fifteen or thirty days in the future. Clearly, there will have to be major innovations in current training strategies and new as yet undiscovered technologies will

---

1 CAPSTONE is a Total Army program to align units in peacetime to their likely wartime contingency chain of command, particularly for contingency mission training.

have to be applied to the challenge. This work is intended to describe both--to serve as a launch pad for a major development effort by the National Guard and DARPA.

This is a formidable task but there are major new tools available to address the problem. These tools are the Army training system as it can be molded to the RC challenge and remarkable new information technologies in the process of commercial development as an integral part of the so-called information age. This paper will integrate both into a maturing strategy to make much better use of time at some resource cost of funds and personnel--the critical resource is time, not money or people--and to reduce the effects of distribution of individuals and units in the reserves.

B. NEW OPPORTUNITIES

Remarkable opportunities abound in training. The Army has defined task, condition, and standard as has no other Army. Individual and collective proficiency have been defined. Successful implementation programs are fielded such as structured lane training at least for active forces and combat support and combat service support reserve forces. Now there are new opportunities in simulation--subsistent, virtual, and constructive. We are accustomed to subsistent simulation as we append MILES to our equipment--Tactical Engagement Simulation--"instrumented ranges or maneuver areas for actual military vehicles in which engagements are singly simulated." Virtual TES involves "manned simulators that engage in wholly synthetic computer-generated battle environments." Constructive TES is "computer models of military campaigns in which engagements are aggregated." They combine to present a broad array of training opportunities as defined above and in Fig. 2.[2]

Emergent training technology provides a flexible bag of training tools. For small unit training, subsistent and virtual simulation seem best; for battle/staff training, virtual and constructive are probably most effective. Leader training can draw on all three. The challenge is to combine all three to obtain compression across distributed units.

---

2 Paul F. Gorman. "The Future of Tactical Engagement Simulation," *Proceedings of the 1991 Summer Computer Simulation Conference, July 22-24, 1991*, Society for Computer Simulation, Baltimore, 1991, pp. 1181-1186.

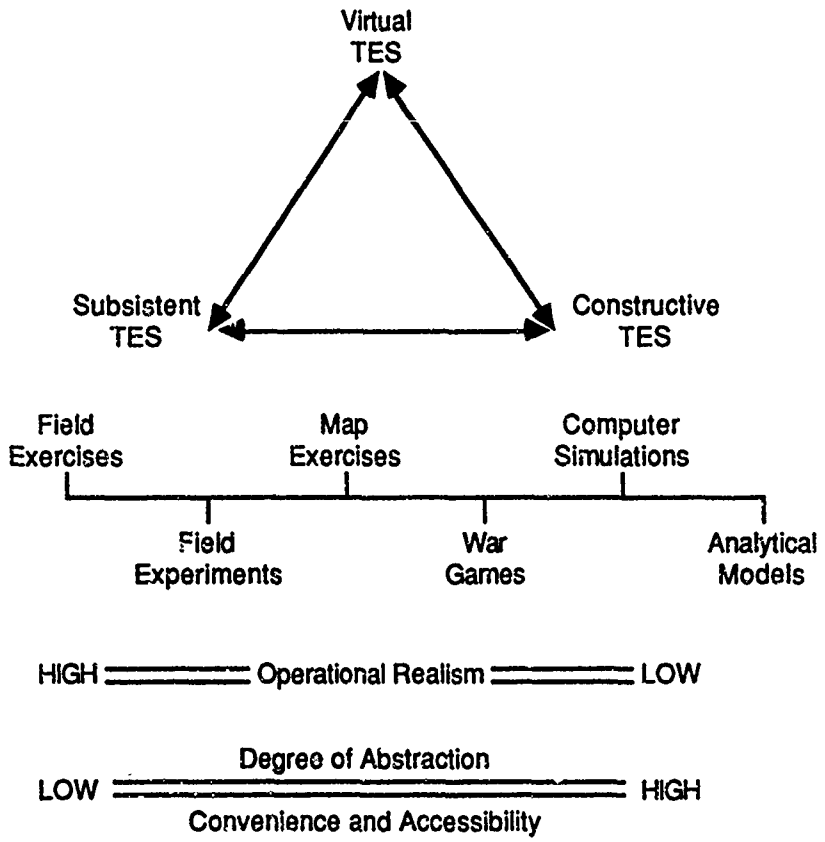


Figure 2. A New Paradigm

The promise of simulation has been noted by Senator Nunn in a recent strategic appreciation. Continuing support appears likely:

IV (A) Major Investment in Simulators

To insure combat proficiency at adjusted readiness and reduced operational tempos, the Department of Defense should launch a major program to invest in simulators to permit enhanced proficiency training without employing expensive field training. Third and fourth generation simulators now permit sophisticated training that was not possible five years ago.

For example, it is now possible to link tank crews in simulators in Kentucky with artillery units in New England and helicopter pilots in simulators in Texas to train together as a combined force, and even to "fight" against similar combinations of simulated "enemy" forces linked electronically from various locations around the country. In the past, such sophisticated training was possible only by putting battalions into the field in expensive exercises.

Similar opportunities exist for maintenance and logistics personnel, and for simulating shipboard operations.

> The Services have gradually increased their use of simulators, but a major expansion in the use of simulators is now necessary. For planning purposes, I have assumed that we may have to spend between $2 and 3 billion more on simulators than is currently planned in order to fully implement a flexible readiness approach. . . .
>
> Senator Sam Nunn
> *Implementing a New Military Strategy: The Budget Decisions*,
> April 20 1990, p. 15.

New potentials in training are matched by remarkable advances in technologies of distributed information. We are approaching rapidly a watershed in capability to present training in diverse locations but networked to a common battlefield. Best of all, we are capitalizing on a major national technology thrust:

> The computer industry, and the visual entertainment and education industries, are rapidly merging. They are all converting to high resolution images. . . . and are using speed digital technology for signal processing, signal recording and signal distribution.
>
> House of Representatives,
> SubCommittee on Technology and Competitiveness,
> May 1991

There are certain to be major economies of scale available for distributed reserve training as both education and entertainment industries converge. Thousands of distributed units are a formidable challenge looking forward from the perspective of traditional reserve training. Looking back from a future of millions of interactive presentations in average homes, it is a trivial problem. How to influence that future?

C. ORGANIZATION OF THE DEVELOPMENT EFFORT

This study attempts to do just that as it proposes training development and technology development as well as a management program to cause an order of magnitude change in reserve training. (Extract of Statement of Work at Enclosure F.) Chapters II, III, and IV hypothesize a future training strategy, a "mark on the wall" to focus technology development to specific training purpose. Chapter II describes broad general conceptual guidelines for both training and technology development. Chapter III expands the guidelines and applies them in greater detail to small unit training. Chapter IV does the same for leader training. Each is designed as a "stand alone" package for the developer. Chapter V defines major areas of technology development by describing applications appropriate for Guard execution of the projected training strategy. Both DARPA technology thrusts and a possible management structure are described in Chapter VI with

illustrative technology teams and research agendas indicated. Enclosures provide additional detail of critical aspects of the overall strategy such as conceptual design of the tables, post-mobilization training and evaluation.

This effort addresses long-term training readiness deficiencies identified most recently in the aftermath of Operation Desert Shield. The initial application therefore is to heavy forces, company and below. The proposals have been coordinated informally in draft with both FORSCOM and TRADOC Headquarters, the National Guard Bureau, and the U.S. Army Armor Center as the proponent for combined arms armor forces. There are no substantive disagreements with the desirability of either the "target" training strategy or the technology objectives--training support. Once specific programs from the general concept are selected for execution, there are certain to be issues involving prioritization of resources.

The scope of the effort is extraordinarily broad. Several actions have been taken to focus the effort:

- The panoply of training from individual to collective in institution and unit is narrowed to small unit training in the unit and leader training in both institution and unit. Improved battle command/staff training is proposed as it contributes to battalion training readiness, but a comprehensive model is beyond the scope of this effort.
- The greatest training and technology development to date has been with heavy forces, Abrams and Bradley-oriented. There is existent infrastructure which can be used or improved to assess proposed actions. It is generally agreed that the greatest training readiness challenges in Desert Shield related to reserve maneuver forces. Combat support and combat service support are clearly important; however, they are not addressed in this study other than in their impact at maneuver Battalion and below. Direct and general support combat and combat service support will have to be addressed in a follow-on effort based on the maneuver unit training strategy.
- Clearly, light forces and intense battle command/staff training are important and will have to be included in any comprehensive program. They are included in recommended demonstrations but most of the analysis relates to heavy forces as the focus for the initial application.
- Internal and external evaluation of both the development process and the resultant training strategy is vital. A methodology for establishing Proofs of Principle and Training Effectiveness Analyses is recommended so there can be timely evaluation. Detailed planning must await DARPA/NGB decision as to specifics of study implementation.

- The rationale for new training exercises and training programs is spelled out in Enclosures. This is intended to be in sufficient detail to aid understanding and to support preparation of detailed training programs.

The first challenge is to define new training concepts.

II. CONCEPTS FOR RC TRAINING

The Army training mission is to prepare soldiers, leaders, and units to deploy, fight, and win in combat at any intensity level, anywhere, anytime.

- *The training focus is on our wartime missions.*
- *Our top priority is training.*
- *Maintenance is a vital part of our training program.*
- *Realistic, sustained, multi-echelon totally integrated combined arms training must be continuously stressed at all levels*
- *Every soldier, leader, and unit training program must be carefully planned, aggressively executed, and thoroughly assessed*

General Carl E. Vuono,
FM 25-100, *Training the Force*, p. 1-1.

The guidance is clear; the United States will fight its ground wars with a Total Force of Active, National Guard, and Army Reserve units. The general focus of training doctrine is to prescribe broad principles then describe general approaches to the design of implementing training at all levels. These principles set the course for all training:

- Train as Combined Arms and Services Team
- Train as You Fight
- Use Appropriate Doctrine
- Use Performance-Oriented Training
- Train to Challenge
- Train to Sustain Proficiency
- Train using Multi-Echelon Techniques
- Train to Maintain
- Make Commanders the Primary Trainers

FM 25-100, pp. 1-3 to 1-5.

The principles have now been proven successfully recently in combat, both low and mid intensity in two very different theaters of operations. They work and they are increasingly accepted for application in foreign armies. Yet the preponderance of the literature is directed at active component soldiers, leaders, and units with frequent reference to reserve forces differences which mandate unique RC programs. The basic thrust is, however, active. It does not generally acknowledge the unique challenges of reserve forces, specifically the serious limitations of time for training and the varying levels of individual soldier and leader competence caused by limited, geographically distributed professional development opportunities. Many reserve soldiers cannot progress as their career field dictates because the service opportunities simply are not locally available.

The purpose of this chapter is to propose specific conceptual guidance which should govern the application of army training doctrine to reserve soldiers, leaders, and units under the general umbrella of the Army Combined Arms Training System promulgated by TRADOC. It will consider and expand current training guidance for reserve forces such as is expressed in the National Guard *Integrated Training System.* The guidance should address AC-RC differences suggesting appropriate applications of training and technology developments for unique challenges of the citizen-soldier. To that end, this guidance should not only assist in the execution of ongoing readiness training despite the challenging constraints which govern reserve training, but also it should channel training development by the reserve leadership supported by the branch proponents and accompanying technology development. The methodology proposed herein attempts to describe a general model for development. To provide focus, the general model is related to a proposed National Guard-DARPA program to improve significantly the quality of National Guard readiness training.

The objective for the proposed National Guard/DARPA program is to apply simulation technology and an intensified training strategy in order to create an order-of-magnitude improvement in the effectiveness and efficiency of reserve forces training. Order-of-magnitude change means change well beyond current experience and current expectations; change that will involve high risk technology development beyond the charter of the Services or Reserves. For purposes of defining the developmental challenge, order-of-magnitude change in the effectiveness and efficiency of training would permit, by 1998:

- Improved pre-mobilization training such that the current training benefit of one week of intense summer training (AT) could be achieved in one weekend Multiple Unit Training Assembly [MUTA] 4 or 5 by 1998; or

- Improved post mobilization training such that a current sixty day training program could be compressed to 15 to 30 days by 1998.

- Alternatively, rather than reduce the training time, it would be possible to increase the content trained within a fixed period by two or three times.

This is bold change but it is not unprecedented. Processor capability has a continuous record of more rapid change for at least the past two decades. Training development has revolutionized army training during the same period. Neither development has been focused intently on specific problems of distributed reserve training to date. This effort does precisely that. It identifies the areas of greatest leverage in training development, technology development, and Army policy. Then it establishes a set of conceptual directions within each leverage area to guide and evaluate development during this decade. Finally, it applies the conceptual directions to two major areas of Army training: small unit training and leader training with major insights relating to Battle Command Staff Training (Battalion and Brigade) resulting in specific policies and programs for execution and evaluation during the next five to ten years.

The conceptual description which follows is based on personal experience training reserve forces for 13 years. This period was interspersed with assignments involving conceptual development of the Army Training System blended with command responsibilities in warfighting units training for contingency operations and at the Combat Training Centers as they developed. The concepts have been discussed with experienced commanders of active and reserve forces at all echelons; they are grounded in practical experience. Experience can mislead, however. Therefore, intense continuing evaluation of technology and training development by Proofs of Principle and Training Effectiveness Analyses is proposed as an integral part of the overall program.

There are four areas of significant potential leverage in effecting substantial change. They are *Compression, Distribution, Modernization*, and *Pricritization*.

A. COMPRESSION

Compression of the training process will increase both effectiveness and efficiency of training. The intensified training readiness strategy will compress current and projected training to increase significantly the intensity of training which has itself been made more effective in training task proficiency to standard. There are several elements to compression. One element is to create a training environment which stimulates much more

rapid learning by immersing the trainee in intense battle situations in an interactive process of coaching and after action review. A second element is creating new training support and techniques including training exercises which can be used easily and effectively to compress training time requirements in a variety of training locales by a chain of command of varying capability. While the reserve applications above are new and the enabling new technologies vary in risk, all proposed has been validated in tactical units over the years. Compression is primarily a training development problem. The risk in achieving beneficial change is low; the risk associated with compression for order of magnitude change is high.

B. DISTRIBUTION

Distribution is provision of appropriate training and training support to the Guard soldier or unit at the best location to provide effective training. It is intended to reduce significantly the impact of physical separation of reserve soldiers and units that serves as a detractor to effective training. The intent is that training support--simulators and simulations--travel, not soldiers. Travel can be ground mobile, such as is required by mobile simulators. Preferably, the distribution is gained by moving electrons by satellite or optical fiber ground links with all appearing in a proper tactical context on a seamless battlefield of subsistent, virtual, and constructive simulation in a manner desired by the commander charged with the training responsibility. Distributed simulation should be low cost--hundreds, not thousands, of dollars:

- It should provide variable resolution--from micro terrain (that is, resolution to the road crater level of detail with fully manned units maneuvering on digitized terrain) to one leader able to "man" an apparent manned fighting Brigade actually represented by semi-automated forces.
- It should provide flexible networks ranging from a Battalion Staff conference call with each staff officer coordinating from his unit armory or own home to Command Post Exercise (CPX) training involving the chain of command of a contingency operation netting to the Theater Commander.
- Lastly, the electronic training support should be commercially available, for purchase and repair, across the country. Cost should be comparable to the current cost of home cable.

Improved distribution enables mutual focus on a common virtual battlefield, either common contingency areas for leader and unit collective mission training or common terrain for exercises at the Armory, Local Training Area, or Major Training Area. As such, there is a potential to increase unit bonding--thereby greatly limiting the disruptive impact of

unit dispersion--with time, the greatest impediments to unit readiness, Company level and above. Applied to leader training, distribution permits flexible decentralization all the way to the home, permitting remote training and evaluation to standard as desired by the chain of command. Distribution is a technology development problem. The overall risk of distribution described is low. It is being pursued vigorously by the entertainment industry. The risk of achieving massive low cost distribution of improved resolution simulation is high.

C. MODERNIZATION

Modernization refers to the development of new technologies supportive of intensive reserve training. It applies simulation technologies in several areas to permit revolutionary change in the process of reserve training. It will provide virtual and constructive realities supportive of intensive immersion training. This enables "seamless simulation" essential for flexible multi-echelon training. This will be supplemented by a detailed real time documented evaluation program supportive of chain of command training. The intent is not only to reduce personnel overhead required to conduct training, but also to return the responsibility of executing quality training from the external "expert," Observer/Controller, to the unit commander. Modernization will also provide highly flexible multi task training support designed to improve the training productivity of existing and planned simulators and simulations, as well as the use of actual equipment. Lastly, it should reinforce the merits of Distribution in enabling a fundamental shift in the loci of training--moving it closer to the local armory or even to the citizen soldier's home. Modernization is a technology development problem. The overall risk of modernization is medium to high.

D. PRIORITIZATION

Prioritization is determining the most important tasks which units have to train to be mission ready. It calls for review and revision of the Total Force training requirements for leader, small unit and battle command/staff training. As the Army assesses force generation requirements for maintaining forward presence, projecting power, and force reconstitution, new variable training requirements emerge. Combat unit training requirements for Reserve Forces were scrubbed during the Combat Training Center training for Desert Storm. New pre- and post-mobilization training requirements appear certain perhaps with basic generic training to priority missions before mobilization. Then,

the priority would shift to highly battle-focused training post mobilization when the Mission Essential Task List (METL) of the potential battle area is known. Prioritization is a national policy issue of strategic readiness with precise requirements definition by the CINC, the Department of the Army, and, in detail for specific training programs, by the TRADOC Proponent. The overall risk of detailed training requirements prioritization should be low to medium as a result of the focus and training experiences of Desert Storm.

The four areas of general leverage described above, *Compression, Distribution, Modernization,* and *Prioritization*, gain effectiveness only as they are translated to long-term programs both for training development and technology development. Individual policies and programs, however useful, can lose their effect if they are not related and aligned to contribute to the larger, long-term leverage areas. The whole can be larger than the sum of the parts only if a large diverse effort is kept focused. Some intermediate focusing mechanism is required to translate successfully from broad concept to specific programs. The broad principles underlying Army training doctrine are:

- Train as Combined Arms and Services Team
- Train as You Fight
- Use Appropriate Doctrine
- Use Performance-Oriented Training
- Train to Challenge
- Train to Sustain Proficiency
- Train using Multi-Echelon Techniques
- Train to Maintain
- Make Commanders the Primary Trainers

FM 25-100, pp. 1-3 to 1-5.

These are excellent principles but they are not sufficiently reserve-related to direct training or technology development. To focus the development effort, I propose the following supplementary conceptual guidelines for the developers. These encompass each of the four areas of general leverage while attempting to serve as useful guides for training and technology development. The guidelines are grouped by general leverage area supported.

Compression

- Immersion in warfighting
- Train in unit context with complementarity of training on actual equipment and in simulation
- Shift the loci of training
- Train the unit to train (decentralized) while training its leaders (centralized) in the school
- Encourage local "what ifs"
- Chain of command not Observer/Controller training
- Use Drills and Tables to train basics
- Design training to encourage competition
- Encourage supportive unit policies

Distribution

- Distribute training to the lowest feasible echelon
- Incorporate low cost consumer electronics

Modernization

- Develop flexibility of echelon, locale, means and application
- Improve the resolution of virtual realities
- Provide improved networked simulators (freestanding and appended to actual equipment)
- Create new training exercises

Prioritization

- Train "levering" battle tasks
- Institutional training priority for leader training

Now to each in turn.

E. COMPRESSION

1. Immersion In Warfighting

There are two elements here. One is immersion by the total involvement of the soldier, leader, or unit in the training process. This can be done in several ways. The

current Combat Training Center (CTC) technique involves force-on-force training exercises--Situational Training Exercises (STX) or ARTEP-Mission Training Plan (MTP) missions against a well-trained, equipped "enemy" force, itself pursuing an assigned mission and striving hard to win. Under a separate chain of command than that of the unit in training, there is absolute risk from superiors, peers, and subordinates at every echelon of command. In the live fire, direct human competition is supplemented by danger and the obvious Measures of Performance of battle synchronization such as effectiveness of artillery. The point is that the training milieu is designed to place great stress on the chain of command. The CTC is expensive, and not really relevant yet to most RC units which do not have an opportunity to train at the CTC. However, these techniques can be readily introduced at RC Battalion Training Centers. The 73d Separate Infantry Brigade (SIB), Ohio Army National Guard, has executed this form of structured training at Camp Grayling, Michigan, as has the 32 SIB Wisconsin Army National Guard at Fort McCoy, Wisconsin.

Total involvement can be achieved by other means. Provided there is sufficient training opportunity, the rigor of task, condition and standard, and the ability of simulation and simulators to replicate engagements or battles precisely provide numerous opportunities for inter- or intra-unit or leader competition. Local reward or punishment can accompany success or failure in performance to standard. The best current example of this capability is the Abrams/Bradley Conduct of Fire Trainer (COFT), which can measure performance to precise standard anywhere in the world. There is no theoretical reason why this methodology could not be applied to small unit table exercises or to collateral operations involving staff coordination such as Counterfire or Joint Air Attack (JAAT) provided the ability to "freeze" and replicate specific actions to high resolution is built into the battle simulation/simulator. Physical conditioning is increasingly precise with Nautilus type devices. There are some on-equipment training exercises such as Pre Combat Checks, which can be made "immersing" but it is more difficult to exploit to achieve genuine immersion through competition on the ground because it is much harder to control variations in task, condition, and standard and thereby maintain "fairness." Nevertheless, on-equipment living and mair taining--the life of the mounted warrior--needs to be made much more immersing in the average armory, WET, or LTA site for combined arms heavy forces.

The second major route to immersion is involvement in continuing battle. It is the design of the training-leader, small unit, or staff--such that there is an ongoing real-time

campaign to which the training audience can relate. Not only does this establish a continuity of tactical context for training activities, but it also excites personal commitment to the outcome--not letting down one's friends in difficult situations. Where possible, the fortunes of war should vary so there is a combination of likely actions of varying difficulty--crawl, walk, run--so the training audience continually faces demanding new situations requiring coordinated soldier and collective performance.

Current training doctrine envisages this as Train to Challenge, varying the conditions of training. Reserve application needs to be much more pervasive so that two to threefold increases in effectiveness of training characteristic of immersion training can be achieved routinely during IDT as well as AT training.

2. Train in Unit Context With Complementarity of Training on Actual Equipment and in Simulation

The potential for achieving immersion is reinforced as training is conducted in a unit context. That is, the tasks, conditions and standards are trained when feasible in the context of a unit involved in a continuing "warfight." Where possible there is the thread of continuity of METT-T which bridges the time gaps between reserve training periods where considerable time can be lost as the trainees are read back into the situation when they reassemble for training. Tactical continuity not only facilitates immersion but also it retards the training decay between Unit Training Assemblies (UTA) as the soldier is stimulated to recall actions in "bull sessions" with his or her buddies in the workplace or socially.

This approach extends to all soldier, small unit, or battle staff training. The NCO in BNCOC-RC is trained in the context of his unit--company and platoon--in the field conducting various combat operations including sustaining. The field context should be applied for all training including the development of generic leadership skills. The officer training in the Officer Advanced Course is similarly returned again and again to a common tactical situation. The Abrams or Bradley Company "fights" through IDT to AT against a likely contingency force. Maintenance of self and equipment is provided the backdrop of reconstitution after a tough fight or the venue of assembly area actions prior to offensive operations. All training experiences are designed (structured) to achieve specific combat-oriented task proficiency.

The battle staff (Battalion or Brigade) supports the commander in an ongoing campaign which requires coordination across all battlefield operating systems and from

senior headquarters to subordinate units engaged in combat. Students are required to occupy different staff positions executing basic level battle command/staff tables knowing that their performance will be measured against established Measures of Performance and discussed in repetitive AARs. The unit staff will generally remain in their assigned positions executing basic then expert level Battle Command/Staff Training Tables and STX. For additional discussion on battle staff tables, see Enclosure B.

Developing the training packages for training in the fighting unit context will be challenging; the technological challenge to create appropriate entry to the "warfight" will be tougher. The AFV commander will need to be able to fight a single AFV, section, or platoon "UCOFT matrix" from a SIMNET-like cabinet in his armory. Alternatively, when he can get on the actual equipment and gain the essential experience of fighting, maintaining and generally living on the AFV itself--a major lesson learned from Desert Shield train up--he still needs an entry port to the battle. This port should draw on the actual fire control or vision capability of the equipment. When the staff officer is training his or her skills, they too should be in a combat environment whenever possible. Best is staff action during combat from an actual or simulator-command post track. Next best is a TV type interactive workstation which provides visual access to the battlefield available in the armory or home--an individual port to the battlefield.

The responsibility of the training developer is to develop this training in a logical sequence. The technology developer's charge is to create and distribute the enabling subsistent, virtual, and constructive simulation at sufficiently low cost that it can be distributed widely.

3. Shift the Loci of Training

Traditionally, the exciting unit tactical training, the highlight of the training year, comes at Annual Training. Only then can the unit assemble with its battlefield combat support and combat service support for a field maneuver exercise. In recent years there has been increased emphasis on development of individual and AFV crew skills during weekend training (IDT) so that the unit "can train to level authorized" during AT when the entire unit can be together long enough--two weeks--so that some necessary collective task proficiency--bonding--can occur. The training is driven by the limits of assembling personnel to necessary training support--that is, equipment, terrain, etc. This confining constraint can and must be broken to effect major change in the efficiency of reserve training.

The objective is to apply training and technology development to permit the shifting of the loci of highly effective training from AT to IDT at the will of the commander. Once the training is placed in a unit battle context and flexible entry is provided to the "warfight," significant increases in training effectiveness can occur. The commander will have been provided recommended training strategies and the capability to design his training to provide a logical succession of task training in combat vignettes during both IDT and AT. A company tactical table fought in the armory in distributed simulation on a Multi Purpose Range Complex (MPRC) physically located at the regional RC Battalion Training Center (RC BTC) could be the pre-train for "fighting" a Combined Arms Live Fire Exercise (CALFEX) on the same MPRC on the ground as the unit starts AT. A tougher tactical table involving weapons or support unsafe to employ at the RC BTC could be executed by the unit in distributed simulation while still at AT or after it returns home for IDT. Conversely, concerned about his units' platoon and below on-equipment training, the commander could validate the higher unit's AT gates (CALFEX or prescribed set of tactical tables) at IDT so that the entire AT can be devoted to on AFV "fighting" in a series of structured lanes--ten days of intense, 24-hours-per-day structured combat at the platoon level. Of course, the on-equipment tables or STX combat vignettes would be designed to ensure execution of battlefield maintenance, Pre Combat Checks, and appropriate field crafts. In time, a similar shift should occur with institutional training.

The development objective is training support such that the unit commander would face a series of very demanding, specifically defined combat situations (Tables or STX) to fight and win (and train). But at the same time he would be given much more flexibility (wherewithal and authority) to prepare for his "warfights" training--virtually independent of location. For additional discussion of tactical tables, see Enclosure A.

4. Train the Unit to Train (Decentralized) While Training its Leaders (Centralized) in the School

The Total Force training system prescribed in FM 25-100 and 25-101 is extraordinarily effective but it is complex. It requires in-depth understanding of the process of training, and technical proficiency in the use of the diverse training support which has been made available. This support is outstanding, but it must be used in a disciplined manner. The currently issued Abrams/Bradley Conduct of Fire Trainer is highly training effective, by training test. Successful COFT performance correlates well to on-vehicle gunnery table performance. Yet COFT effectiveness is very dependent on competent

control of the training experience by the Instructor/Operator. If he cues the AFV commander and gunner to coming events, the training capability of the COFT can be greatly reduced.

Similarly, Tactical Engagement Simulation (MILES) must be employed in a disciplined training environment or the training benefit is severely degraded. Inoperative lasers, faulty boresight of weapons, removal of batteries which cue target hit or covering of laser receptors are all showstoppers to positive training. Ill-trained or undisciplined Observers/Controllers or Opposition Forces who do not fight in a doctrinally correct manner can erode the effectiveness of the best training support. Commanders who have not been properly trained to mission task proficiency so that they demonstrate incompetence rather than competence as they lead an After Action Review are a liability rather than an asset. In sum, the current training system and its sophisticated training support are very powerful--positive to a disciplined unit, but negative to the undisciplined.

The potential of misuse is exacerbated by the decentralized nature of our training system. Great latitude is left to the local unit commander in the detailed design and execution of his or her training program. This decentralization is both practically necessary and doctrinally correct. The diversity of the mission challenges across a globally distributed force mandates decentralization to the battle focus of each chain of command. Airland Operations leave broad discretion to the commander at each echelon to fight consistent with the intent of the next higher commander.

The active force response to this challenge is insistence on leader competency--leading by example--so that the training system is executed by knowledgeable commanders at every level. And the training system is taught "hands on" in the institutional courses. Commanders are trained in the use of training support as a byproduct of the normal schoolhouse training. This should be expanded in the reserve forces where the training product is much more distributed. The training development objective is to place centralized institutional training in the decentralized environment of the unit. Train the leaders in a highly intense, quality control-disciplined environment exactly as you expect them to train their subordinates in their units so that they are taught both the techniques and the discipline of the training system. As the leader is trained on the COFT or in distributed simulation to either basic or expert levels of proficiency, he is taught how to use the distributed training support to train others to the same level. Demonstrated proficiency in training others as they would be trained in a unit should be an objective of the institutional training.

The usual dilemma for the training manager and developer is how to design the schoolhouse training to train to proficiency at the minimum cost in dollars, people and time. The answer normally involves creating "mass production" use of training support to increase efficiency using resources without compromising effectiveness. The very act of "mass production" in the schoolhouse creates a training environment unlike that of the unit so the leader often graduates with technical proficiency but without practical knowledge or experience in application to improve or sustain proficiency in his or her unit. This is what needs to be corrected in the design of new leader training courses for reserve forces. The Guard challenge is not to conserve resources in the training base, it is to use centralized training to ensure leader proficiency and motivation to implement a very hi-tech decentralized training program with quality control maintained through internal and external evaluation. For these reasons, execution of RC leader training should be quite different from AC leader training.

5. Encourage Local "What Ifs"

Even if the average unit has a competent, disciplined chain of command that genuinely wants to train, the very high levels of intensity of training needed to achieve significant compression of the time required to train to proficiency will be very difficult to achieve unless the enthusiasm of the unit is captured and focused to training. The individual and collective imagination of the unit needs to be drawn to training. Immersion and the conduct of training in the unit-at-war context are designed to generate this spark as is encouraging productive competition. Both of these measures should increase the productivity of the programmed training period. We need more; we want to so involve the unit in the training that they want to come in on their own to train. Development of a "what if" capability is intended to respond to this. We have all wanted to try something else tactically to see if it would work more successfully. What if we had used Fire Support longer?, if the enemy had placed a Platoon at that Road Junction?, if our Attack Helicopters had arrived fifteen minutes earlier?, if we had refueled at the last Lagger?, if we had placed the Battalion Aid Station in the valley? The tactical training (Tables and Situational Training Exercises) should be annotated with "What ifs" appropriate to the training objectives of the particular exercise. In addition, the training support should be designed so that these sorts of additional training experiences can be easily and quickly set up in the simulation. As possible, similar capability should be encouraged in structured lane training on the ground, although once the unit is on the terrain the normal challenges of set-up, competition for

terrain, and administration limit leader flexibility to so tailor the training. Conversely, a SIMNET-type simulation available in the armory, capable of instant or delayed replay at any point in the operation, would encourage local experimentation.

That is really the point. Encourage local experimentation, local initiative, the Yankee ingenuity characteristic of Americans, the certainty that "we can do it better than ----". Training designed to evoke these reactions then enabled for "on your own time" training will support remarkable intensification of the training experience.

6. Chain of Command--Not Observer/Controller Training

The Army Training System has developed a highly effective infrastructure to enable quality collective training. That is the structured lane training like that most currently employed by the National Training Center in the training of the 48th Brigade, Georgia Army National Guard, for Desert Shield. This lane training consists of a combination of doctrinally correct Situational Training Exercises, trained Opposition Force, Tactical Engagement Simulation (MILES), structured After Action Review and trained Observers/ Controllers who overwatch the execution of the training exercises and then conduct the After Action Reviews where much of the effective training occurs. It is expensive training with high personnel overhead, but its value in ensuring consistent quality collective training to standard has compensated for the overhead. The expanding Combat Training Centers employ this training technology as do the maneuver institutional training centers. This training is in the process of being institutionalized for combat unit training at Regional Training Centers by FORSCOM and the Guard in a major effort to improve Guard training beginning in FY 92--Bold Shift. While the initial focus is the Round Out Brigades, the prescriptive structured training strategy being implemented is very similar to what is proposed in this study.

There are several potential risks to this training strategy which can be corrected with thoughtful development in the future. The first is that the process of training/evaluation tends to be taken away from the unit chain of command. The intensity of the training, to advantage limited periods of time at the CTC, is such that the chain of command is pressed to keep up with the evolving tactical situation. With a demanding pace, new terrain, and an accomplished OPFOR, the average unit is struggling to gain the initiative. There is little time to reflect and correct deficiencies pointed out in the AAR. There is virtually no time to go back and "do it again." As the training is centralized to achieve the proper extended range, continuous operations training environment for the modern battlefield, and optimize

the considerable resources required to conduct the training, flexibility is taken away from the unit commander.

And, the Observers/Controllers tend to dominate as they analyze, comment, train, and evaluate with the same intensity that the unit is experiencing in training. Dependent upon personalities, the relationships between O/Cs and chain of command can vary from outright hostility to "we-they" to genuine acceptance of useful support from confident chains of command. Preemption of the chain of command, while undesirable but often unavoidable for the active unit, is corrected when the unit returns to its home station and reengages in its normal training. This corrective factor is less correcting in the reserve unit which "peaked" its field training time to execute the centralized field training. A chain of command which believes that the training, however good, was taken out of its hands, which was compromised in the minds of subordinates because they kept "getting killed" and then has no field training time to reestablish itself in command, is not a happy chain of command.

These are clearly disadvantages but they should not preclude the use of intense structured CTC-type lane training for the reserves. The challenge is to use technology to minimize or to compensate for the disadvantages. One alternative is to design simulation-based lane training to standard which could be experienced by the reserve unit at home armory on CTC or RC BTC terrain prior to or subsequent to the on-the-ground training. Distributed simulation can permit pre-CTC fight and refight on digitized terrain of the same missions with the ability for the chain of command, not O/Cs, to analyze the battle from every vantage point at any time. Alternatively, CTC AAR documentation could be designed so that the unit can refight structured battles by recreating them in simulation back at the Armory where the chain of command can refight, again without O/Cs, so the chain of command is dominant.

Another approach is to improve the instrumentation of the equipment at the CTC or RC BTC so that detailed timely information can be provided to the unit chain of command on the battlefield. Then the unit can conduct the AAR itself. O/Cs could be present to assist the chain of command in collecting data desired by the command, but the O/Cs assume a much more subordinate role. After all, the unit at war will not have O/Cs; the clear need is to develop the competent total unit under the unit chain of command as rapidly as possible.

We do not want to reduce the use of the structured lane. It is absolutely proven in training effectiveness in war. The real challenge is to look at how we can develop new techniques of training support that can serve to ease the challenge of the training burden for the average reserve unit commander. And we need to be sensitive to the time required by the chain of command to ensure leader tactical and technical competency to replace the O/Cs. A major development effort--with appropriate Training Effectiveness Analyses (TEA)--will be required to field efficient pretrain material for commanders about to lead by example, particularly in IDT training. New exercises and capabilities are required. Enclosure A discusses possible designs of leader pretrain modules.

7. Use Drills and Tables to Train Basics

There is a need for doctrinally correct training exercise and training support specifically responsive to AT and IDT chain of command requirements in dispersed reserve units. Current training exercises focus on various combinations of the use of actual equipment in training. This not only reflects the genuine need to become skilled on the equipment we will actually fight on but also it reflects past lack of alternatives. Other than jeep exercises, there were few opportunities. Unfortunately, on-equipment training is itself limited--limited by resource constraints of ammunition, fuel, and spare parts, and limited to those tasks which are physically or ecologically safe to train in peacetime training. Now we have a range of training alternatives in simulation and simulator. Yet often we limit their use to training those tasks we are accustomed to training on equipment--those safe or affordable in peacetime but not necessarily the tasks we may face in war on a 360 degree battlefield at night. So there are opportunities to train new tasks, including some incorporated into really challenging battle situations (perhaps Desert Storm driven) designed to immerse or to stimulate "what if" or to encourage professional competition. In short, training on new battle tasks which might even be "fun" to train, particularly if you could do it down at the armory.

Similarly, we think and schedule training in the unit field context. Expected number of daily repetitions is influenced by the known complexities of range set-up, travel time to the field, continuing maintenance needs and the time to brief, conduct the training, prepare then conduct the AAR then recheck the MILES or fix the targets or clear the animals off the range or...the friction of training. The end result is modest training productivity when we are actually training. It is worse when we have the range set up or guard or OPFOR or other support responsibilities for the other companies in the

battalion--all associated with structured on-equipment training. The administration can be overwhelming.

What if there was none of this overhead? What if you could move directly to a row of cabinets on tractor trailers and transport your company into a virtual simulation such as SIMNET and engage rapidly in intense battle--a sequence of Company Frag Order, Fight, AAR; Frag Order, Fight, AAR; Frag Order, Fight, AAR all in a period of time you would associate with executing one good platoon lane on the ground at AT (4 hours)? Simulation should be designed to achieve these kinds of efficiencies executable at the armory or in the assembly area at the LTA in mobile simulators just before or after the unit executes the operation actually on the ground.

Training Exercises themselves can be supplemented to enable these efficiencies. Much of the time required to conduct Situational Training Exercises (STX) is consumed in Troop Leading Procedures--necessary but not always requiring the total training environment to train effectively in these skills. Tank Combat Tables have been in effect for several years. Both the tank gunnery and tank tactical tables present a series of tactical vignettes--a series of increasingly difficult (crawl, walk, run) STX but with the Mission, Enemy, Troops, Terrain and Time Available (METT-T) fixed and specified in detail beforehand. This reduces the Troop Leading Procedure time and also ensures specific focus for unit pretraining. The challenge is to demonstrate proficiency in basic tasks (Tables) before advancing to the battle-focus of the Situational Training Exercises (STX). Are similar tables appropriate for basic mission performance at company team or battalion task force echelons? Company tables are currently being developed at Fort Knox as an effective way to use simulation (SIMNET) to train leaders. Specified tables could be very effective for Guard small unit training in simulation and perhaps on the ground at WET or LTA site. Combined with semi-automated forces in simulation, they could also be useful for leader and staff training. Battle command/staff training would appear to be particularly amenable to the use of tables for initial team training. Both are discussed in Enclosures A and B.

The AAR process could be improved significantly by designing it to be conducted by the chain of command itself drawing on the data collection capability built into simulation. Agreed Measures of Performance can be collected as the exercise proceeds, then collated and presented for the commander's use shortly after completion of the exercise. These could be supplemented by a "guided tour" of the battle designed to support discussion of command training objectives. After a brief AAR, the battle could be

reinitialized and some key AAR aspect refought manned or employing SAFOR so that the unit members can all view and discuss the action as it unfolds in front of them. There are almost unlimited possibilities in our ability to support more intensive AARs designed to be conducted by the chain of command. As long as the training is table-related with specific METT-T, it should be possible to provide an AAR of the "school solution" of that Table to assist the commander in leading the fight, then preparing to conduct the AAR. As the tables are developed with specific METT-T, a great measure of standardization is applied to the small unit basic training process. Simultaneous training and internal evaluation is enabled, a precondition for effective training. At the same time, necessary external evaluation is made much easier.

There are other ways the training program can be designed to support the chain of command in conducting the training itself to a quality standard (without O/Cs). If the unit is training tables rather than STX, leader training packages can be prepared--essentially expanded tips for the trainer which discuss the table in detail: what the critical tasks are; how the various battlefield operating systems interact to accomplish the mission; likely tasks that will need remedial training; useful ways to discuss probable training deficiencies in typical units executing the tables; suggested changes to METT-T to bring out various teaching points in subsequent "fights," etc. This kind of detailed execution support is as relevant for leader and staff training as it is for small unit training. The point is that today's training technology can be much more focused to support typical challenges in training distributed Guard units. Training development must be forced hard as the technology is pressed to respond to Guard training challenges. For more extended discussion, see Enclosure C.

8. Design Training to Encourage Competition

Immersion training in a warfighting unit context is by nature tough, demanding, and unrelenting. It should be, the bottom line is battle--closing with and destroying the enemy before he can destroy you and your unit. That degree of proficiency and competence requires demanding training. Training which permits failure but rewards competence. Training which increases in challenge as the unit progresses (crawl, walk, run). The overall training must develop the leader as it develops the unit.

There are a number of techniques to support this training process and more can be designed into training programs as we learn more about the design of training itself. Battle vignettes (tables) can be designed to move the unit in the progression from basic to expert

proficiency in rather precise steps of increasing difficulty. This is precisely the challenge in post-mobilization training. Enemy forces can be introduced to increase the pressure; time can be restricted; friendly resources can be reduced. However done, the challenge is to develop a cohesive unit, competency-based to fight and win. Leadership must be based on demonstrated competence in warfighting. Leaders should be placed in situations where they must demonstrate their competence to all--leaders, peers and subordinates--if there is to be a competency-based force, not a bunch of marginally competent "good old boys." Nothing here against highly competent "good old boys," the issue is that a first class unit requires continuous challenge so that the chain of command is competency-based. That is why the CTC has been so important and useful to the Active Force. Very few of the Army's current leaders have not been tested "at war" in the CTC.

Competition can create these healthy tensions for distributed units unable to participate frequently in externally controlled CTC-type battles where the commander can lose it in front of his soldiers if he is not competent. As we know, competition can take many forms. Unfortunately, it can often be unproductive. The challenge is to foster competition against the competency-based standard. Performance on a company table exercise could be the object of competition within a Battalion. The objective training system should be designed such that it encourages distributed competition in warfighting tasks against a capable enemy.

9. Encourage Supportive Unit Policies

Quality training cannot exist in a vacuum. It is the result of a total effort within the unit or schoolhouse. The most obvious support is direct acknowledgment of training proficiency, such as promotion of the leader whose unit does well in demanding training, or the special mention and perhaps award to the individual or crew that excels on a Table. Support can also be negative, of course, if poor training proficiency results in remedial training while other individuals or units with more consistent performance to standard are rewarded.

These are the more obvious aspects of support. Others equally important are reflected in the training programs laid out in FM 25-101. Supportive policies are necessary, such as chain of command insistence that unit administration be reduced if not curtailed during priority training time. All are aware how good training can be eroded or amplified by support or lack thereof from the chain of command. The point is that good training cannot exist in an indifferent command climate. The highly intense immersion

training described here is even more dependent on positive command support at each echelon or it simply will not happen.

F. DISTRIBUTION

1. Distribute Training to the Lowest Feasible Echelon

Although this appears self-evident, it really is not. In fact, it is a major philosophical issue in the training of landpower. In many nations, training at all echelons is very centralized, reflecting in some nations how they intend to fight. Standard blocks of instruction expected to be trained to common lesson plans at the same time in a centralized dictated training program are common to many nations. Not only is the training program dictated but also execution of as much training as possible is achieved in centralized locations where senior personnel can ensure that the training doctrine is being executed as directed.

Not so in the United States, at least for training in units. We gain standardized performance in critical areas of proficiency by an almost revolutionary advance in the science of war. That is the codification of military training requirements in a set of individual and collective tasks, conditions, and standards--The Systems Approach to Training. Embodied in the Soldier's Manual and the ARTEP-Mission Training Plan, we now state with great and measurable precision what constitutes proficiency. Against this rigorous, carefully defined and precise requirement, we can decentralize unit training to a remarkable degree. That is precisely what we have done during the past several years as the training doctrine of FM 25-100 and FM 25-101 has been promulgated and enabled in a very sophisticated training system. Under the rubric of battle-focused training, each commander designs his own unit training program to train for the likely warfighting missions. We have quite deliberately decentralized, at least for active forces. Almost as an afterthought, these policies and programs have been applied to the Guard and Army Reserve.

We have remained with traditional "dictated" centralization only in our critical officer and individual soldier initial entry training, where we have decided that there is a best way to socialize to the profession of arms and we want it executed in a single "best" way, particularly for reserves. Basic Combat Training and Officer Basic Courses are

carefully monitored to ensure rigor and standardization of approach.[1] More senior leader training is a mix--standardization in the schoolhouse, particularly in courses designed for reserves, but with a majority of the leader development left to the chain of command in the unit. To ensure satisfactory execution of this important training which has been decentralized, the Army has established centralized Military Qualification Standards to validate officer proficiency as Skill Qualification Testing was instituted earlier for soldiers. Staff training has been left largely with the unit chain of command but with some rigor established by evaluated training at the CTC and numerous staff training simulations provided to institution and unit. Policies and practices for the active force have been routinely applied to the reserves.

Routine application of this enormously successful active force training philosophy--decentralization qualified by rigorous standard--to the reserves may not have been helpful to overall reserve force readiness. It is extraordinarily difficult to develop leader proficiency for citizen-soldiers. Leader preparation has been estimated to consume 25 to 50 percent of the time of the peacetime active army. That is more than the total time available to citizen-soldiers for unit training and administration. Battle focus is not particularly useful guidance to a Guard unit commander who will not know which contingency his or her unit may be required to reinforce after mobilization. In any event, presumably much of the intensive mission training would not occur until after mobilization. Basic level proficiency on the warfighting "basics" may be the best leader training objective pre-mobilization. These are genuinely difficult issues. The answers probably involve a mix of increased decentralization to a national organization distributed to the micro level (reserves) and increased centralization of more frequent training evaluations. The best mixes must be determined by test.

Given the great diversity of our Nation and the reserves, there will be many "best" answers. However, in the context of decentralization of training to a nationally distributed force, there seems a clear case to place as much training capability as possible in the hands of the individual guardsman or reservist. Certainly to the individual small unit leader--to platoon--and to the battalion echelon staff officer--the Captain S2. For the small unit, distribution to the Squad Leader/AFV commander is probably as low as training support

---

[1] There is considerable variation in the degree of standardization executed in officer training between the various Army branches of service. Equipment dominance in armor units forces focus on standardized training on equipment. Infantry training, basically soldier- not equipment-oriented, is more decentralized in execution. Both are fully satisfactory approaches provided that all training is conducted to standard and is subject to both internal and external evaluation.

should be available at least in the home. While this may seem startling, perhaps wasteful to the active force observer accustomed to focus by unit (Battalion) by Post or Garrison, it is overdue recognition of the extraordinary distribution of reserve forces which justifies unique policies and programs. The complement to remarkable distribution enabled by emerging technologies is provision of rigorous individual and collective training packages designed for quality execution to standard. The communication means which permits decentralization is also the network which can provide detailed performance evaluation feedback back up the chain of command. Extraordinary decentralization does not infer loss of quality control. The challenge for the training and technology developer is to enable this. Distribute the training to Squad/AFV, Platoon Leader, and Battalion Staff Officer.

The end result of this is more than providing training support to the lowest echelons. As this support is networked for training in virtual or constructive simulation, advanced networking really inserts effective new communication to compensate for physical separation within and between reserve units. There are certain to be benefits from the increased bonding in units particularly as they are jointly immersed in a common "warfight." In case of doubt, over-distribute!

2. Incorporate Low Cost Consumer Electronics

There are two issues here. First and obvious, whatever is developed must be sufficiently inexpensive and maintainable that it can be widely distributed and easily maintained or repaired. Second, less obvious, what is needed is not a gold watch. Not quite a sundial but close. Perhaps a $10 throwaway, i.e., modest performance, is quite sufficient.

It should be evident that the training strategy being proposed is not all that revolutionary from a theoretical training perspective. The fundamental precepts remain, some policies shift to accommodate the reserve training environment and some new programs are proposed. What is different is the serious distribution of the training support almost to the individual guardsman--quite different from current practice. This level of distribution mandates a low unit cost. Initial development may well produce "battle portals --workstations permitting individual interaction from the home with the battle on the virtual battlefield--costing thousands but eventual production costs 1996+ should be in the range of a then mid size color TV and VCR plus competitive cable hook up costs. Hopefully the componentry can be repaired or replaced by the Radio Shack or equivalent on a contract basis. It would be useful if various options to improve resolution and

interactivity could require commercially available hardware or software so that the using unit or individual could have some local flexibility to tailor the capability to local need.

Surprising new capabilities to bring entertainment and education into the home are coming rapidly as consumer electronics, education, and entertainment merge. The Guard should advantage this entertainment revolution for distributed reserve training--not waiting for the active force, which has neither the same urgent requirement nor the funding.

The second aspect is different. The design philosophy is not to have the best, it is to have the just good enough to do the job. The job is to train to proficiency--to train with simulation or simulator in conjunction with other devices and field training as a part task trainer. One hundred percent individual or collective task training capability is not required. Fifty percent resolution or training effectiveness on selected critical tasks available distributed to the guardsman's home, sufficient to give entry to the virtual battlefield by the average leader or soldier, may well be sufficient. That is much better than what is there now. Unless and until training test can demonstrate that more than 50 percent resolution will benefit the training proficiency of the average individual, 50 percent may be enough. This is a vital point. "How much is enough?" is one of the absolutely dominant issues in this development effort. Some answers may be counterintuitive. Training Effectiveness Analyses should be used extensively. Then, the technology will continue to mature; more will be available for less. In principle, as the capability matures, strive for the same capability for much less. See "Improve the Resolution of Virtual Realities" (G.2 below) and Chapter V for additional discussion of part task training; Enclosure D discusses the essential evaluation requirements.

G. MODERNIZATION

1. Develop Flexibility of Echelon, Locale, Means and Application

Reserve forces face a remarkable diversity of training requirements. Each local situation requires a slightly different response. Therefore, there is great advantage in providing as much flexibility as possible to the local chain of command. Each of the capabilities discussed below should be modifiable at as low an echelon as possible, preferably at Battalion.

a. Flexibility of Echelon

The training support should be capable of being incorporated into the virtual battlefield at the appropriate echelons. For example, an AFV simulator should be able to fight on the common virtual battlefield at the individual AFV, platoon, or company echelons. A simulation of platoon battle should stand alone against an OPFOR company or be capable of being included in a company as a part of a battalion action. This flexibility to vertical echelon (platoon to brigade) should be supplemented by similar flexibility by battlefield operating system. That is, although the training focus may be to Maneuver, Fire Support and Command and Control of a Company Team executing a tactical table, the training support should also be capable of representing the other battlefield operating systems such as Intelligence, Electronic Warfare (IEW), Combat Service Support or Air Defense by addition of hardware and individuals or Semi-automated or Automated Forces to man the additional BOS. The provision of this flexibility will permit the chain of command to advantage various training exercises. For example, given this flexibility, a brigade commander could use an ongoing company team tactical reaction table to generate fire support requirements for staff fire support training also being conducted during that weekend, and a regional Officers Advanced Course could draw on the same battle to support leader development vignettes--"What now Captain?"

b. Flexibility of Locale

Training support should not only be suitable for use in small unit, leader, and staff training, it should also be capable of being networked into the virtual battlefield from the unit armory, the unit in the field as at Annual Training, or the home or worksite of the leaders.

c. Flexibility of Means

The individual or unit being trained should be provided the flexibility to choose the training support means recommended by the training community or mandated by the local situation. That is, if the commander wants to conduct a particular exercise on equipment from the WET or LTA site, the means should be available. Same if the preferred means is simulation or perhaps entry to the battle from an AFV command track. There are advantages associated with each in terms of the degree of compression achievable. Therefore, the commander at the lowest possible level should be able to make the decision.

d. Flexibility of Application

This is probably the most important aspect of flexibility for the unit commander or schoolhouse trainer of leaders. This flexibility would permit practice either as an individual leader or in a small leader group in a variety of locations--official or private--including homes. Current simulation permits training as: self plus all others represented by SAFOR (in simulation) similar to playing Solitaire or computer games. Current simulators provide similar potential capabilities. UCOFT today provides an excellent capability for highly structured training distributed worldwide with quality assured by the design of the training matrix. As currently fielded, limited discretion is permitted an Instructor/Operator who must be present to set up and control the training situation. In general, both vehicle commander and gunner are required to "fight" the AFV. Future modification should increase the flexibility provided the chain of command such as enabling training of either vehicle commander or gunner with the other and/or the Instructor/Operator represented in Semi-Autonomous (SAFOR) mode. Another flexible alternative could be self plus several others plus SAFOR, or similar combinations where the mix of actual equipment and simulations/simulators can be varied to suit the training audience in a hybrid simulation which mixes actual equipment and simulators or simulations practically interchangeably. The point is to design the training support to achieve the maximum flexibility in use as far down the chain of command as possible.

2. Improve the Resolution of Virtual Realities

Improved resolution is a trap of rising expectations by those who, uncertain as to what simulation is supposed to do, demand that it be "just like" the real thing. The challenge here is "How much is enough?" The answer to this is "What are you trying to do?" An AFV precision gunnery trainer needs detail comparable to the resolution of the fire control and the gun-ammunition combination of the actual combat vehicle. If the real tank can acquire and kill to 4,000 meters range, the resolution of the simulator should permit the same if absolute replication of performance in simulation (100 percent) is the requirement. On the other hand, if the training requirement is to replicate 75 percent of likely engagements (at one-half the cost) resolution to 2,000 meters is probably sufficient. The problem is to determine exactly what behavior is to be represented or simulated, then determine the appropriate cues. The virtual reality must include those cues. For example, if the task is to create a personal car driving trainer, a bug on the windshield can be omitted, a red traffic light must be included. Represented on SIMNET, this was called selective

fidelity. Include only cues for tasks to be trained in order to keep the cost down. As discussed above, this is critically important conceptual guidance for reserve forces because it tends to drive the cost and thus the distribution of the training support.

A second decision is how much do you want to pay for improved resolution today in light of continuing product improvement to volume fielding which will not occur for at least four years? There are difficult training choices. Assume x dollars spent today will provide relatively low resolution in simulation--the ability to acquire a battlefield target only out to 1500 meters. However, predictable product improvements over the next four years should permit acquisition to at least 2000 meters for x dollars spent four years from now. 1500-meter resolution may be sufficient. Not what I would like but enough for IDT applications because I can train to greater ranges on the actual equipment at AT.

Now, what should my decision be if my x dollars invested today--acquiring to 1500 m--will be sufficient to field only six battalions and one RC BTC. To equip all battalions and RC BTC, I can only afford x-y dollars per simulation which buys resolution only to 1000 m or 1500 m if I wait four years. Which mix is best? How much is enough? These are the kinds of trade-off guidance which must be given to the technology developer after the training developer has defined the training objectives. That sort of homework and independent evaluation is absolutely essential. Also see the discussion in Chapter V on this issue of resolution (p. V-9).

Some general improvements over the resolution of SIMNET are clearly necessary in both what is represented and how rapidly it can be produced. While the primary initial focus of training is the close combat heavy organization, objects relevant to the AFV and infantry squad, mounted and dismounted, need to be represented. Since we train for continuous operations, reduced visibility should be included. Cues to comparable level should be provided for all of the battlefield operating systems. Terrain representation should be to squad level, that is, sufficient detail to permit selection of squad sectors, not detailed enough for siting of individual weapons. In general, new terrain (WET, LTA, MTA) should be able to be created in digitized terrain in 90 days.

Longer term improvements should be directed at driving down the cost of the characteristics listed above and at improving the quality of the "battle portal" available to the small unit and the individual. Governed by the cues which need to be presented to permit the immersion training to occur, there should be steady improvement in screen detail and level of interactivity permitted from distributed locations and eventually some form of three-dimensional representation, provided that there is proven training effectiveness. Enabling

low cost and effective distributed immersion training in a unit context is a very high priority.

3. Provide Improved Networked Simulators (Freestanding and Appended to Actual Equipment)

A credible "battle portal" to the virtual battlefield is absolutely essential to the intensive small unit, leader, and staff training sought. Several portals or participative "windows" are required. Most important is some form of networked portable cabinet which represents the appropriate AFV--something similar to the current SIMNET cabinet. This should be available in the armory or any centralized on-equipment training site for use prior or subsequent to on-terrain training exercises or in central locations for leader or staff training. Considering the quantities required for the distributed Guard force, the cost should be lower than the current SIMNET cabinet with the capability to train the same tasks including selected training matrices comparable to the current COFT to approximately 70-80 percent verisimilitude. (Percentage should be verified by ARI or other analytical agency in a Training Effectiveness Analysis.)[2]

A second "battle portal" should be appended to the actual tank to improve the productivity of on-equipment training at the Armory or WET, LTA site. Guardfist has opened new ground in appended training simulation. Future development should permit initially one-way then two-way transport of the individual AFV to the virtual battlefield--the Instrumented Abrams/Bradley. Initially, the AFV at the CTC or RC BTC could enter the battlefield with its actions portrayed to the other virtual fighters in virtual and constructive simulation. Then some aspects of the virtual simulation could be distributed to the actual AFV. These capabilities would permit significant intensification of on-equipment training as vehicle crews in the weather, having to maintain their actual equipment are ported to immersion training.

The third battle portal is some form of interactive portable "window"--workstation--which would permit the leader or staff officer or student to enter the virtual battlefield to

---

2 This cabinet is not a Close Combat Tactical Trainer(CCTT) nor is it intended to replace the CCTT. The CCTT will be a higher resolution simulator designed primarily for AC expert and mastery level training. The RC "buy" should provide 4 hours training per year for reserve battalions in a combination of fixed sites and eleven mobile non-networked platoons. The Abrams/Bradley Trainer described above and elsewhere for development purposes is a lower cost part task trainer affordable for wide distribution to armories so that it can be consistently available for weekend training. It may have some capabilities such as networking to various locations envisaged for the product improved CCTT. If so, such capabilities could support earlier fielding on CCTT improvements.

participate in table or STX training. This Commander-Staff Trainer could represent the Commander's vision ports from the Abrams or Bradley. Eventually this portal should be sufficiently low cost and maintainable to be distributed as cable television is available today. It should be available for home-based training or comparable locations proven conducive to effective distributed training by Training Effectiveness Analysis.

The three devices suggested above would not only tie together subsistent, virtual, and constructive simulation, they would also enable interactive immersion training across the reserve force. See Chapter V for additional detail on this potential training support.

4. Create New Training Exercises

Order-of-magnitude change in training effectiveness is unlikely without some modifications in the baseline training programs. Training developments and emerging training technology ensure new opportunities for change which may in fact become preconditions for success. Several opportunities arise from the concept of distributed immersion training in a unit warfight context:

A new training exercise is needed to complement the Situational Training Exercise. The STX is excellent for the unit which has mastered the preceeding Drills and has to train to battle focus for contingency missions. However, because of the great variations in METT-T, no two STXs may look the same unless they are embedded in structured lane training which essentially fixes METT-T for tutorial purposes--and rigorous evaluation and retraining. For exactly those reasons and drawing on the successes of AFV combat table training, company team and battalion tactical tables are proposed as a new exercise for reserve training largely but not exclusively for unit training in virtual simulation. Knowing the METT-T of the unit in training permits the development of sophisticated pretraining modules for the chain of command so that not only can outside "experts" support the training but also much more productive AARs can be prepared for chain of command use. There are additional applications of this table exercise for leader and battle command/staff training. For additional detail, see Enclosures A and B.

Another exercise is the development of "living history" in virtual simulation. Imagine a high resolution re-creation of a battle from Desert Storm which you could enter as a unit commander and experience second by second what happened to the actual unit commander. Then at a critical moment, you take command--thereafter friendly and enemy actions are based on your actions and reactions. Then go back in replay and compare your

actions and results with those of the actual battle. Such a simulation is presently being prepared by DARPA, ETL, IDA, and the Chief, Military History.

Should such an experience be included in a special very intensive immersion training course for Close Combat Heavy small unit leaders? What other immersion events should be included? What about other very high stress battle vignettes including those in a mock-up AFV where in the middle of heavy contact in immersion virtual reality, your AFV is hit, your Gunner loses a limb and you come under an Attack Helicopter attack? What now, Captain? At what point could how much such practical, hands on immersion training period count as the Advanced Course for reserve leaders?

H. PRIORITIZATION

1. Train "Levering" Battle Tasks

This is an issue of Army training doctrine, of prioritization as it relates to reserve training. Current doctrine in FM 25-100 and 25-101 mandates a structured planning process to ensure not only timely advance planning but also availability of resources necessary for quality training. The doctrine also requires a detailed analysis of missions resulting in development of a Mission Essential Task List leading to focus on "battle tasks." Each unit can have different battle tasks based on mission planning.

Now, the situation has changed. Most forces will be associated with projection operations in contingency situations--contingencies anywhere in the world. The situation is even less certain for the reserves, particularly the Divisions assured a training period prior to deployment. In their case, a generic list of important tasks to train to combined with suggested training exercises would seem very useful. Not only would this narrow the focus of normal peacetime training but it would also permit development focus on improved training in those tasks or missions. Since this narrowing appears to be the *de facto* consensus after Desert Storm, such a training policy decision has been assumed for this effort.

There is a second issue here. That is the complexity of tasks (or conditions) expected to be trained? We define crawl, walk, run tasks and conditions as we lay out tables. Perhaps there are also basic (pre-mobilization), expert (post-mobilization) and mastery (A/C) task lists? The flexibility to do this has been incorporated into the tactical tables described in Enclosure A. That appears a useful way to distinguish between pre- and post-mobilization training conditions for reserves as it puts a "mark on the wall" for

active component forces. This would seem an appropriate issue for Training Effectiveness Analysis.

2. Institutional Training Priority for Leader Training

Leader training is one area where proposed policy and program for reserves is different than for active forces. Doctrinally, active component training of leaders is very much a responsibility of the unit chain of command and the individual himself or herself. It is assumed that the chain of command is fully competent to train its subordinates. Institutional training is provided and it is considered important particularly for initial training--the socialization of the citizen. Continuing education is encouraged but in a number of ways not solely the responsibility of institutional training.

The validity of this model can vary greatly in reserve units. The problem is a serious need to reinforce the tactical and technical competence of unit leaders while providing satisfying unit training, all on limited time. A focus of this study is to achieve order-of-magnitude improvement in leader training in the institution. There is also a need to train the leader to reinforce and eventually supplant the Observer/Controller in the execution of structured combat training. Clearly, in the future the unit will need to do more leader training. For now, however, the unit will be provided some training support to enable training of unit tasks by the chain of command as the institution is reinforced to train leader tasks.

III. DESIGN OF SMALL UNIT TRAINING

A. SCOPE

The general challenge is to develop and design a new simulation-based intensified training readiness strategy for the Reserve component intended to create an order-of-magnitude improvement in the effectiveness and efficiency of Reserve Forces training by 1998. Improved small unit training is an essential element of any improvement program.

This chapter addresses training from individual AFV to Company echelon. The focus of the effort is on combined arms heavy combat units reflecting specific challenges during Desert Storm. Similar principles can be applied to combat support and combat service support units as well as comparable reserve units from the other Services. Subsequent work should address Army combined arms light and Special Operating force units.

The purpose of this chapter is to provide a conceptual framework for a comprehensive small unit training program. The chapter draws on the broad conceptual guidance developed in Concepts for RC Training and applies it specifically to the design and implementation of training and technology development to enable the training of small units distributed nationally. Analysis is within current training guidance including FM 25-100, FM 25-101, the National Guard Integrated Training Strategy, and the Army Combined Arms Training strategy.

The focus of this effort is on crew and small unit collective tasks. Individual task training is important but it has already been institutionalized in an highly effective institutional training base complete with elaborate programs recommended for distributed sustainment training. "Hip pocket" training is one such means. It works and it has been fully supported in doctrinal training material available to the Total Force. Noncommissioned officers courses have excellent coverage of individual training. Of course, sustainment of individual proficiency as a MOS 19K Abrams or 11M Bradley soldier is of great importance to small unit proficiency. In this chapter, that aspect is included as crew proficiency. The small unit training program must include time for

drivers and gunners to train as individuals and as members of crews. Similarly, the unit conducts leader training consistently. That training ensures individual skill proficiency of the leaders from AFV commander up. So, although this chapter does not discuss individual task proficiency *per se*, it is understood and accepted as a vital and supported element of any unit training effort. We assume that "hip pocket" training and evaluation to standard is going on continuously.

There are three levels of unit training proficiency: basic, advanced, and mastery. All training is of course to standard as prescribed in the ARTEP-MTP. For purposes of training development for this program, basic level is defined as understanding actions--Tactics, Techniques, and Procedures required to cause actions to occur and ability to "make it happen" for designated critical ARTEP-MTP missions. To define training requirements and develop training exercises, basic level is set as the pre-mobilization level of training proficiency for reserve units. Basic level consists of "bread and butter" missions such as the following being incorporated in tables being prepared for reserve training at the Armor School: Assembly Area Operations, Tactical Road March, Movement to Contact, Hasty Attack, Hasty Defense, and Resupply.

The next general level is expert--that is, a collective ability to cause action despite distractions, countermeasures, and unanticipated weather. This is an objective level of proficiency after mobilization but before deployment. More tasks have been included to the basic level reflecting METT-T in the objective area of operations. In addition, tasks trained at the basic level are now trained at the advanced level to more challenging conditions. For example, for the Desert Storm train up at Fort Hood, the company team modules for structured lane training post-mobilization were:

CO/TM ATTACK	CO/TM DEFENSE
Assembly Area	Tactical Road March
Tactical Road March	Hasty Defense
Passage of Lines (Fwd)	Deliberate Defense
Movement to Contact	
Breach	
Hasty Attack	
Assault Resupply	

III Corps Briefing 03/91 Roundout Brigade Training

Based on the actual mission focus of Desert Storm preparation, it seems reasonable to assume that this list is representative of post-mobilization small unit collective training requirements.

The highest level of proficiency is mastery, the ability to see and exploit before others are aware there is a problem or opportunity. This does not appear to be a reasonable level of proficiency to expect from citizen-soldiers prior to deployment. We expect that proficiency from the full time Contingency Force units.

The focus of the policies and programs suggested here is to develop basic small unit proficiency from citizen soldiers prior to mobilization and expert small units post-mobilization prior to deployment to combat.

Consistent with Army training doctrine, to achieve objective effectiveness and efficiency of development, any new technology and training strategy should be performance-oriented and draw on the rigor of the Systems Approach to Training (task, condition, and standard). Moreover, particularly for the reserves, it should be hands-on, conducted on actual or virtual terrain whenever possible. In addition, it should embody the basic principles of Army training in FM 25-100.

Post-mobilization training is a separate challenge. The same general policies and programs apply but the challenge is to accelerate significantly the training process. That capability is integral to the training discussed here. Pre-mobilization training support assembled at mobilization training stations will permit peacetime economies to be applied to intensive wartime training to contingency METT-T. Cadre unit training is a special case requiring applications of technology to permit execution of unit training strategies without the continuing presence of subordinates--such as representing all echelons (company and below) in simulation with capability to introduce soldiers selectively as required by the chain of command in training. This appears doable with the technologies of virtual and constructive simulation. The training and technology developments to be discussed for small unit training appear applicable for cadre training. Realize, however, that the sections and platoons simply cannot be trained until proficient individual soldiers are present. Simulation can be no substitution here. See Enclosure E for additional discussion of post-mobilization training.

B. DEVELOPMENT FOCI

Small unit training involves four levels of organization: the individual Armored Fighting Vehicle, expanded by the infantry squad in the case of the Bradley, the section,the platoon, and the company (Pure or Team: cross-reinforced Tank/Infantry). While each of these levels is important, particular emphasis is placed on the platoon as the building block

of the company. In fact, when company training is discussed, the platoon gains particular importance because it is the company with tank and infantry as well as trained fire support expertise that sets the context for platoons. So there is considerable discussion of company training but much of it is from the perspective of ensuring solid, demanding training of platoons.

All programs must focus on conserving time by causing training to occur in a very intensive training environment resulting in rapid learning in locales most accessible to the small unit. The criticality of time is such that all training must be designed to conserve time. It is not an issue of using simulators or simulation to conserve by increased effectiveness and efficiency; *all activities* including unit training on actual equipment *must be designed to save time.* And most if not all the unit training requirements should be structured not only to save time but where possible to bring the training itself as close to the citizen soldier's home or peacetime place of business as possible.

Major levering areas for development of intensified small unit training are *Compression* (involving new exercises/training techniques), *Distribution and Modernization* (involving new technologies for training) and *Prioritization* (involving Army prioritization of training requirements). It is to this conceptual framework that we look to create the objective small unit training capability described above. Major principles influencing training and technology development are:

1. Compression

Intensified RC small unit development is created by compressing the training process through:

a. Immersion in Warfighting

Presently, the only consistent immersion training for the tank unit is tank gunnery when, infrequently, the unit undergoes the challenge and excitement of platoon level Gunnery Table XII. This kind of intense involvement needs to be expanded to all unit training whether in the Armory or LTA or at a more extensive AT site. Immersion for the unit can best be a unit fight presented as a succession of vignettes tied to a common battle or campaign.

This is difficult to achieve. All of the training requires some form of external support--training support or personnel or both--as it is structured to create the combat

situation. Companies simply cannot create the modern battlefield either in active or reserve units. It is simply too big, too complex. An effective "stage" for creating the immersion battle needs to be provided to the small unit. In armory or LTA, that stage is virtual or constructive simulation, probably representing the AT site where you will subsequently train in subsistent as well as virtual and constructive simulation. The point is that immersion training support comes from the chain of command.

Furthermore, the unit leadership has to be present--relieved of administrative burden so they can lead forward as they would on the actual battlefield. Some individual task training can be conducted in a general unit context without all of the chain of command. Battlefield maintenance and specific skills such as Call for Fire or Fire Adjustment come to mind. Some leaders must be there. However, to train the platoon or company by immersion, all the key leaders must be there fighting personally, not standing back as observers or absent conducting administration.

Conversion to immersion training requires more than new exercises and new devices. First and foremost, it requires a chain of command that wants to fight--to lead by example in a demanding series of combat actions. Then it requires a supportive administrative network which releases the commanders from distracting peacetime administration. That means that unit peacetime administration needs to be organized almost as well as the tactical training is or the immersion just will not happen.

The design of the training will influence the training benefit. Vignettes should be structured to refresh as many individual, crew, or section tasks as possible. Hopefully the training will proceed in a sequence of "crawl, walk, run" so that all are challenged but not overwhelmed, at least in basic exercises. The chain of command has to be familiar with the training support to the degree that they can "fine tune" the conditions to gain precise training objectives.

b. Train in a Unit Context With Complementarity of Training on Actual Equipment and in Simulation

For the small tactical unit this means more than train as you are--as a unit. It means also that the unit is always "in combat." Whenever possible reinforce the combat environment. Feed tactically. Repair equipment as you would have to on the battlefield. If personnel must be absent, treat them as WIA who have to be replaced just as they would on the battlefield. The challenge for the training developer is to build these kinds of reinforcing actions or training policies into the training support.

Complementarity is essential to significant compression of training. As you are striving for this realism--to reinforce immersion--you need to be able to move smoothly from one form of training support to another. The continuity of the flow of combat should not be broken as you shift from on-equipment to on-simulation training or the reverse. This does not mean that your simulator or simulation has to be a perfect representation of the AFV or that the digitized terrain must be of the same resolution as the actual terrain. It does mean that there must be a continuity of cues. Terrain is "interchangeable," enemy or friendly dispositions "transfer" easily in the mind's eye. The sensing must be that "you've been there before" as you reenter the battle. Not only does that help to preserve the immersion but also it reduces Troop Leading Procedure time required to read into the situation.

Complementarity also applies vertically and horizontally. Vertically, or multi-echeloned, simulation should be sufficiently "fine grained" to permit individual crew training/evaluation in the midst of a platoon or company action. That is, although the focus of an action may be company, there is sufficient detail of section or platoon actions in the AAR that they will receive almost as much training benefit as the company. Horizontally, the unit training should be structured to integrate as many Battlefield Operating Systems as possible. At the small unit, this really means maneuver and both direct and indirect fire. The unit does not train gunnery then train maneuver. Whenever possible, it trains all together just as all fight together on the battlefield.

c. Shift the Loci of Unit Training

The challenge here is to employ training and technology development to provide the greatest possible flexibility to the small unit commander. The training support for structuring intensive training is significant. At that level of effort, the unit commander should be assured that he can design his training to negate the effects of unit dispersion. That is, he should be able to train most all small unit collective tasks each IDT. The major variable would be the specific training support used. Obviously a full up Multi-Purpose Range Complex (MPRC) live fire gunnery table could only be conducted at the MTA range. With that exception, all of his other training should be achievable in some combination of on-equipment, subsistent, virtual or constructive simulation.

d. Encourage Local "What Ifs"

For small unit training, the difficulty to modify readily a factor of METT-T should be as low as possible. The individual AFV executing a table should be able to "what if" as soon as the AAR is over. A menu of possible excursions based on known issues which arise with standard table execution would be useful to channel interest but individual variations should be easy to set up. The objective is to have the virtual or constructive simulation seen as a "super Nintendo"--an object of interest and competition. As long as all forces take doctrinally correct battle actions, and a doctrinally correct matrix is built into the SAFOR, more involvement by crews, platoons or individual leaders is intrinsically better for the unit training process. So much the better if it is fun. Even better if units want to try tough tactical action tables and challenge their peers!

e. Chain of Command not Observer/Controller Training

Intrusive presence of Observer/Controllers will not be an abiding challenge to chains of command in many small units because it is unlikely that there will ever be sufficient competent personnel to provide this support frequently. Nevertheless, it is important that the average unit be provided training support so good and so reinforcing of quality training to standard that the crutch of O/C is not sought. The challenge to the training developer is clear:

- Develop a chain of command training package that pretrains conduct of the table to accompany each tactical table. If the package has a good reputation, commanders will use it; they do not want to err in tactical lore in front of their subordinates. Aside from unit training benefit, this is excellent leader training.
- Prepackage the AAR so that critical Measures of Performance are assessed as the table is fought. A solid AAR available immediately after the table is completed (15 minutes) will catch the fighters at a time of intense interest and therefore provide very powerful learning. So much the better that this AAR is presented by the chain of command clearly knowledgeable about fighting.

There is also a challenge to the technology developer. It is to package the pretrain and a school solution table and AAR so that the unit commander can train or fight or practice the table interactively at home or worksite prior to the IDT when he and the table will train the unit. The Commander/Staff Trainer discussed in Chapter V would be a great help.

All of these measures will intensify the training process in the unit. They do not preclude the deliberate use of O/Cs by the chain of command if it desires to conduct an external evaluation. Of course the networked nature of the simulation could permit the higher commander to monitor the execution of the table from a stealth vantage point anyway. O/Cs may in fact no longer be necessary as the chain of command finds itself more able to train its subordinates--a delightful state for improved unit training.

f. Use Drills and Tables to Train Basics

Training to task proficiency on small unit collective tasks is genuinely difficult. Platoons and companies are clearly the fighting edge of combat forces and need the most training but they have the most complex training mission with the least experienced personnel. Compare the small unit training audience to that of leader or command/staff training which normally start at the battalion echelon where more experienced personnel (Lieutenant Colonel and Major) are supported by staffs to assist in organizing activity. Moreover, both leader and command/staff training are normally centralized at even higher echelons where more training support resources are available. Because of these realities and the escalating cost of training on complex equipment, increasingly, active units have gone to structured training at the company level to enable such complex training to standard.

The problem is exacerbated for reserve units where all of the problems above are magnified by unit dispersion. Seldom are there units larger than companies collocated so there are virtually no economies of scale in structuring the training such as are available on active unit division-size posts. For example, if an active maneuver brigade is conducting company lane training, there is general overhead which can be applied to support the training. The maneuver platoons of battalion headquarters companies can be used as OPFOR, seasoned staff officers can become Observer/Controllers. Even then, this level of training is difficult to sustain. It is virtually impossible for the reserves other than during AT. Demanding small unit training once every year or two is simply not sufficient to gain and sustain even basic levels of collective task proficiency. It is not enough to sustain seasoned mounted soldiers. So there is a clear need not only to focus severely that which we expect the platoon and company to train but also we need to provide "a way" to execute the training. That is precisely what drills and tables do. They provide "a way." Virtually all collective training in the small unit should be so structured. Enclosure, A Tactical Tables, and Enclosure C, Structured Training, describe both applied to reserve forces.

Structured training applies to traditional on-equipment, on-terrain small unit training as well as training supported by subsistent, virtual, or constructive simulation. As this training is designed for small reserve units, the following should be considered:

- Employ common Tactics, Techniques and Procedures as prescribed in FM 71-123 for all training be it small unit, leader, or battle command/staff. All training should reflect common SOPs.
- Ensure that the training is not only multi-echelon but also multi-functional. Company team tables should serve well for platoon training. As the unit maneuvers, gunnery and maintenance need to be reinforced. All training should stress basic discipline in executing detailed procedures, leader follow-up to ensure performance to standard, and attention to detail. In other words, the training must be both immersing through personal involvement and challenge and immersing in that all elements of unit readiness are stressed and developed. All aspects of the small unit should be stressed whenever the unit executes drills and tables. The quality of the precombat check, the professionalism of frequent boresight, the detail of fire planning, the adherence to unit evacuation procedures--all are fine points which need to be trained and evaluated as the training exercises are developed. Some will be doable only on-equipment, others only in simulation--a challenge for the training developer.

g. Design Training to Encourage Competition

For the small unit, effective readiness will be determined by psychological considerations as much as by training performance to standard. The good combat unit sees itself as a "winner;" good people bonded together, each knowing they can count on their teammates despite the inherent danger of combat. The training program must create and reinforce unit esprit. Competition builds teamwork. Most Americans thrive on competition. We should look for opportunities to use the training support to encourage competition and intensify immersion. This is particularly appropriate where companies are located in small towns or communities which are natural rivals. The training strategy and support should be amenable to locally generated competition--as long as all training competition is doctrinally correct to standard.

The second more subtle aspect to competition is that the pressure of fair competition will tend to competency-base the unit. To win against -----, the town where B Company has their armory, you want the best leadership possible. Just as healthy basketball rivalry encourages better coaches and better athletes to try out for the team, increased competition

will increase natural selection of leaders in the small unit. The best "tanker" becomes the company commander. The Israeli Army has produced quality units for years by absolute competency basing. Competition and flexible leader training may do the same for our reserve small combat units. Leader selection and development is and should remain the province of the reserve leadership. The point is that there is advantage in establishing a strong competition option in the small unit training program.

h. Encourage Supportive Unit Policies

The most effective support to quality immersion training is a chain of command that wants to train. It is a chain of command including higher administrative headquarters which looks for ways to ensure that the greatest number of soldiers are present for IDT and AT training. This paper discusses at length training policies intended to immerse, to create a training support-induced armory training environment so exciting that attendance is not a problem. The unit is at war, the platoon leader needs you. Effective as this is, and it is, the combat mentality will be sustained only if the chain of command wills it. Some possible policies are:

- Select leaders from the most competent fighters--particularly Company Commander and First Sergeant;
- Establish explicit rewards for demonstrated battle proficiency including logistic-maintenance performance;
- Require unit administration to be concentrated in non-tactical IDT; and
- Encourage attendance at leader professional development training.

Most of these are chain-of-command authorities and decisions. They are raised here only to suggest that these or similar policies are integral to a successful immersion training program.

2. Distribution

Intensified reserve small unit training is supported by distributing the training to the lowest leader echelons through:

a. Distribute Training to the Lowest Feasible Echelon

Small unit training support should be available routinely at the company armory. This means more than driving up to the armory on Friday with mobile simulation to support training Saturday and Sunday. Some of the training support must be there all the

time so the unit commander can pretrain himself and his key subordinates prior to IDT. The structured table pretraining package has to be executable when it is most convenient to the hardest working individual, the company commander. The initial objective should be to maintain this at the armory.

As distribution means improve, that capability should move to the worksite or home. At that time, more unit teams need to be tied to the common battlefield. The company commander, second in command, first sergeant and platoon leaders team should be able to net to plan for IDT combat as should the commander and fire support chief (FIST) team and eventually the platoon leader and platoon sergeant team. This capability alone should multiply the effectiveness of the average IDT.

In time, evolution of the Commander-Staff Trainer--which should permit home access to the virtual and constructive battlefields--may permit some part task tank,section or platoon training in the home. The general development objective is to make the training support move, not the soldier.

b. Incorporate Low Cost Consumer Electronics

Low cost is essential to the genuine proliferation of the technology to the armory and below--not on a visiting basis but all the time so the small unit chain of command can rely on its presence. Low cost is also essential as we envisage use in the LTA or MTA/RC BTC assembly area to reinforce directly unit training in hybrid simulation. Capability to move back and forth from table in simulation or on the ground to STX in either can be exceedingly helpful for virtual simulation pretrain prior to on-the-ground execution. Alternatively, it could support another repetition of a table after an AAR. Training support will not and should not be ruggedized as is military equipment yet it must be usable in the diverse environments of military operations. Low cost will permit high attrition--and lots of spares--when the training environment is really hostile.

There is a clear need to review the quality of the simulation required to train small units. The objective is to cue behavior, not recreate reality. Applied to reserve forces, the need is really different than it is for active forces. Training at the expert if not mastery level, the ready active force needs higher resolution training support which can be concentrated at division size installations. The reserves must distribute to hundreds of locations, training to appropriate cues to basic level down at company and below. The active army requirement, the Close Combat Tactical Trainer (CCTT) is neither better nor worse. It is different asking *inter alia* for significant increases in terrain representation

(costly) in simulation which will not be capable initially of being networked (not distributed). The reserves have a special requirement for highly distributable low cost simulation--a requirement which reflects the unique nature and training challenge of the reserves. It also mandates that most of the IDT armory training be part task in nature. Full task training support is generally too expensive to be affordable to distribute to all the armories. Training development has to produce at least two task lists--tasks to be trained at IDT and tasks for training at AT prior to training and evaluation on the full up "gate proficiency table or exercise. For example, a Gunnery Table VIIIX for repetitive IDT training and a prequalification Table VIIIY at AT prior to full Table VIII qualification. Then the training support distributed for IDT training is designed to train to standard on Table VIIIX tasks .[1]

3. Modernization

Intensified small unit training by creating new technology applications to:

a. Develop Flexibility of Echelon, Locale, Means and Application

For the small unit, flexibility really relates to applications within the platoon or company:

- Flexibility of echelon so that the commander can train to task proficiency from individual crew positions, particularly vehicle commander, gunner, or driver, alone or in combination, up to company with battalion represented as it would be directing operations on the battlefield.
- Flexibility in locale so that the unit or key leadership can be assembled to train to basic levels of proficiency from the armory to the RC BTC. Eventually, this capability should be distributed to the home also. The specific locale can vary from a quality fixed installation (armory) to a temporary facility or even a field location at the various training areas. All equipment does not have to have all capabilities, but modification kits should be sufficiently available so that the small unit commander has what he needs when and where he needs it. In all cases, the commander needs effective representation or portrayal of both higher and lower echelons.
- Flexibility of means mandates easy transferability from actual equipment to the various forms of subsistent, virtual and constructive simulation dependent on the unit's training needs. The training focus should be immersion in an

---

[1] Part task gunnery training to standard is discussed in the context of simulator development on p. V-9.

ongoing battle with the nature of the "portal" to this battle changing based on what it is that the commander wants to train.

- Flexibility of application ensures that the training support of choice to the unit commander is available. Several examples of diverse applications are:

Dissatisfied with the leader pretrain package for a particular table, the commander himself may want to "fight" a company table including AAR from armory or home during the week to prepare for IDT training on that table.

Alternatively, the unit Master Gunner may want to refight a particularly difficult tactical engagement with a platoon which had great difficulty distributing fires during a recent coordination table. The Master Gunner wants to refight the engagement again and again as a platoon gunnery exercise presented in UCOFT type matrix.

Another application could be the company commander, his FIST and the platoon leaders fighting under battalion direction with all of the subordinates represented in SAFOR (constructive simulation).

One last application could be flexibility to have one platoon training on the equipment at a WET site linked to the other platoons fighting in virtual simulation from the armory.

b. Improve the Resolution of Virtual Realities

As discussed above, more resolution is not necessarily better, particularly if it drives up the cost so that the simulation is not widely available. For the small unit, the level of resolution depends very much on the intended use. Precision gunnery for Abrams and Bradley places the highest demands. Targets at battle range can appear very small and points of vulnerability even smaller. The resolution provided for the fielded UCOFT is a good representation of this need.

Tactical tables do not require as much detail at range but they do need enough to support tank level of maneuver resolution, that is, terrain to road crater level of resolution with typical concealment. Constructive simulation should be at the tactical table level, again ensuring representation of the appropriate cues for the behavior to be trained. Training developers need to review resolution required to represent the tactical tables being developed by the Armor School. Since the same virtual simulation should be usable interchangeably for both gunnery and tactical tables, that matching may determine baseline resolution. The next issue would be a very demanding meeting between training and

technology developers to determine which tasks could be trained at what necessary level of resolution. *Remember, to be sustained, tasks should be trainable at every IDT.* The IDT training task list must be part task so that sufficiently low cost enabling training support can be provided consistently month in month out at the armory. It may be necessary to divide tables into IDT part task and AT part task components.

Extent and timeliness of terrain creation is another aspect of resolution. Having determined the level of resolution required to cause proper training to occur for the various exercises, considerable thought needs to be given to terrain data base requirements. There are hard decisions on resolution yet to be made. If the data base has to be relatively rich to provide the necessary cues for solid cross-Battlefield Operating Systems representation--even at small unit level--then most effort to support small unit training should go into creating several very rich data bases which all would use. For example, all tables would be fought on that terrain. That would not be all bad, considerable bonding-shared experiences could occur as a result of a shared common terrain data base. However, sooner or later, LTA and MTA terrain will have to be incorporated into the simulation data base because the crosswalk from simulation to the actual terrain can create very powerful training. For the Guard, this would require placing MTAs and some LTAs into the terrain data base.

Design should also permit easy modification of METT-T of the various training exercises to stimulate local "what ifs" as well as for potential competition within and between units.

c. Provide Improved Networked Simulation (Freestanding and Appended to Actual Equipment):

Improve the force-on-force portion of on-equipment training for leaders presently conducted using MILES (Tactical Engagement Simulation). Possible stages of development for force-on-force small unit maneuver training capability are:

- On-equipment, on lanes using MILES (current).
- On-instrumented equipment on lanes using improved subsistent Tactical Engagement Simulation (reflecting time of flight, etc.) in a hybrid environment. Units on the flanks are in simulation unobservable to actual units maneuvering on the actual terrain. However, other units fighting in virtual realities can "see" the instrumented equipment fighting.
- On-instrumented equipment moving on lanes (or stationary in the Armory, WET Site or MATES) fighting interactively with manned and unmanned vehicles and units operating in virtual realities. This is training in a hybrid

mode for combat arms, i.e., crewmen in vehicle on the ground moving but seeing simulations (virtual realities) in vision blocks or when out of hatch.

A potential example of this modernization objective, the second stage, could be training a platoon in their combat vehicles--hot, in a chemical environment, tossed from side to side as their vehicles maneuver across difficult terrain at a RC BTC site being observed by the rest of their company executing several STX in virtual simulation in constructive simulation on the same terrain (digitized) back at the unit armory. All are preparing for a coming external evaluation to be conducted during AT at the RC BTC. See pp.II-25, II-26 for discussion of freestanding simulation improvements.

d. Create New Training Exercises

Virtual and constructive simulation present extraordinary potential to improve small unit training as they recreate practically any conceivable combat situation at whatever level of resolution is required to achieve the training benefit. We have already raised the use of tactical tables up to Battalion echelon. Applications have begun to recreate a Desert Storm battle which could train small unit leaders to the stresses of combat. Other applications will come to create high stress small unit "crises" to bond the unit in training. This just begins to scratch the surface.

Chains of command are limited only by their imaginations in creating new training as new doctrine, equipment, or procedures are developed. Rapid transition training from one tank model to another; unit familiarization for newly assigned officers or noncommissioned officers; training with very hi tech new AFV capabilities available only in the event of war; distributed training with an active round up unit to contingency battle focused training, all are absolutely possible. The challenge is to prioritize those of the greatest training benefit.

4. Prioritization

Intensified RC small unit training by prioritization of training requirements to train leveraging battle tasks. Early in Desert Shield the Army decided to train the Round Out Brigades only on the most important ARTEP-MTP missions. Elaborate Mission Essential Task Lists based on active unit mission planning gave way to training only the most critical tasks. At the CTC-NTC, unit lane training addressed Platoon, Company, and Battalion Offense-Defense,with attention to battle critical tasks: Move, Acquire Targets; Support/ Attack by Fire; Assault; Maintain Equipment; Boresight/Prepare to Fire. That is an

excellent abbreviated task list for reserve pre-mobilization basic level training. New task lists are in the process of being prepared by the Armor School in support of the FORSCOM Bold Shift project to improve the training of round out units. The effort is wholly consistent with that proposed in this paper.

IV. DESIGN OF LEADER TRAINING

A. SCOPE

The general challenge is to develop and design a new simulation-based intensified training readiness strategy for the Reserve component intended to create an order of magnitude improvement in the effectiveness and efficiency of Reserve Forces training by 1998. Better leader training is an important element of any improvement program.

This chapter addresses both unit and institutional or school house (centralized or distributed) training of leaders from Armored Fighting Vehicle (AFV) Commander to Brigade Commander. The focus of the effort is on combined arms heavy combat units reflecting specific challenges during Desert Storm. Similar principles can and should be applied to combat support and combat service support units as well as comparable reserve units from the other Services. Subsequent work should address combined arms light and Special Operating force units.

The purpose of this chapter is to provide a conceptual framework of a comprehensive leader training program which can in turn focus training and technology development. Analysis is within current training guidance including FM 25-100, FM 25-101, the National Guard *Integrated Training Strategy* and the Army Combined Arms Training strategy. There is more execution detail suggested in this chapter than in the two preceding chapters because of the complexities caused by the division of leader training responsibilities between unit and institution. Development for one may not be appropriate or necessary for the other. Discussion of implementation measures should bring out these differences for consideration of the policy decision maker.

There are three different leader training requirements addressing different levels of officer and noncommissioned officer leader responsibilities. They are: *AFV Commander*--execution of increasingly complex tasks such as those required of an Abrams Tank Commander or Mechanized Infantry Squad Leader; *Small Unit Commander*--traditional officer combined arms coordination tasks such as leading Abrams and Bradleys with fire support in a Hasty Attack and *Battle Staff*--execution of battlefield operating system synchronization required to fight Airland Operations. Training technology should address

each of these broad requirements in a manner which will permit ascending individual and collective proficiency from basic entry (understand interactions required to cause action to occur and can "make it happen" to level organized) to expert (ability to cause action despite distractions, countermeasures, fatigue, etc.) and some to a mastery level (sees and exploits before others are aware there is a problem or opportunity). This chapter focuses on the training of the AFV Commander and Small Unit Commander. Battle Staff training is introduced in Enclosure B.

The focus of the policies and programs suggested here is to develop basic leader proficiency from citizen-soldiers prior to mobilization and expert leaders post-mobilization with perhaps some small percentage of full time reservists attaining active force mastery proficiency hopefully before mobilization.

Consistent with Army training doctrine, to achieve objective effectiveness and efficiency of development, any new technology and training strategy should be performance-oriented and should draw on the rigor of the Systems Approach to Training (task, condition, standard). Moreover, particularly for the reserves, it should be hands-on, conducted on actual or virtual terrain whenever possible. In addition, it should embody the basic principles of Army training in FMs 25-100 and 25-101.

Post-mobilization training is addressed as a separate challenge. (See Enclosure E.) The same general policies and programs apply but the challenge is to accelerate significantly the training process. Cadre unit training is considered a special case requiring applications of technology to permit execution of leader training strategies without the continuing presence of subordinates--such as representing all echelons, Company and below, in simulation with capability to introduce soldiers selectively as required by the chain of command in training.

B. DEVELOPMENT FOCI

Quality leader training is at the heart of any organized military force. This is particularly true for the United States' military where significant flexibility in execution is left to small unit leaders. The essence of mission orders places great reliance on common understanding of the commander's intent executed by competent and confident leaders, both commissioned and noncommissioned officers. This philosophical approach not only optimizes the individual initiative characteristic of the American soldier but also it advantages the enormous decentralization of capability and responsibility permitted by the

computer. For these reasons there has been a recent major and successful effort in the active army to improve leader preparation.

Leader preparation has been more successful with active than reserve forces. Direct translation of professional courses from active to reserve has often been impaired by assuming:

- Genuine active force professional development requirements (such as peacetime unit administration) are necessary for reserves *with vastly different peacetime requirements.*
- Unit chain of command competency and time to train subordinates in distributed units *yet full branch competency cannot be an absolute prerequisite to command in many reserve units. Time is severely constrained for citizen soldiers' career development and many units are not located to permit developing assignment experiences as is commonplace for active forces .*
- Genuine active resource constraints of funds and personnel apply to reserves *whose primary constraining resource is time.*

None of these is a "showstopper;" however, the combined effect can cause serious deficiencies in reserve leader training. It seems imperative that a major effort to improve leader training address these systemic problems even if there may be considerable variation from current AC-oriented leader training programs. Leader training within the institution should focus on wartime "warfighting" tasks in the execution of Airland Operations. Training in peacetime administrative tasks including State-mandated administration training can be left to the peacetime chain of command which is responsible. Technology should be developed to support either requirement.

The leader training experience should be designed to be stand alone. Design the leader training assuming that there is very little spillover impact--tactical and technical competence--from prior officer or noncommissioned officer service. This is difficult but not insurmountable. The active force faced a similar situation in rebuilding the noncommissioned officers corps after Vietnam. The Battalion Training Management System (BTMS) and the original Noncommissioned Officers Education System (NCOES) Programs of Instruction assumed minimum pre-knowledge.

The program implication of spotty professional preparation is that any training in either institution or unit should assume meager existing leader competence. Therefore, the commander/trainer should be provided specific preparatory training before he or she trains their subordinates. Then the commander/trainer should be provided effective usable

training support in the form of "guided" AARs to aid them in the conduct of subsequent training of their units .

This all suggests that the major focus of leader training for the next decade should be improvement of individual leader proficiency in the institution with as much reinforcement as is possible from the conduct of unit training. Structured multi-echelon training (Tables) can and should be designed to reinforce leader tactical and technical competency to standard with suitable internal and external evaluation. For example, as distributed structured training is networked, common tasks and standards could provide a vehicle for institutional support of distributed unit tactical training of both leaders and subordinates to standard. That is, unit training of leaders could be supported by the institution such as an "MTT" from the school "coaching" a MUTA 4 Command Field Exercise by observing then providing AARs of leader performance via distributed simulation (Stealth). This would be roughly comparable to the distributed Battle Command Training Program support provided to reserve units today by the Combined Arms Center at Fort Leavenworth.

All programs should focus on conserving time by causing training to occur in a very intensive training environment resulting in rapid learning. Further, the training should be conducted in locales most accessible to the citizen soldier trainee. The criticality of time is such that all training must be designed to conserve time. It is not an issue of using simulators or simulation to conserve by increased effectiveness and efficiency; *all activities* including leader training on actual equipment *must be designed to save time*. And most if not all the unit training requirements should be structured to save time and, where possible, to bring the training itself as close to the citizen soldier's home or place of business as possible.

Major levering areas for development of intensified leader training are *Compression* (involving new exercises/training techniques), *Distribution and Modernization* (involving new technologies for training) and *Prioritization* (involving Army proponent prioritization of training requirements). Supplementary conceptual guidelines influencing training and technology development and potential implementation areas are:

1. Compression

Intensified reserve leader development is created by compressing the training process through:

a. Immersion in Warfighting:

Conduct training in immersion situations where the leader is "immersed" in actual or virtual realities structured to achieve specific training objectives. That is, for appropriate tasks, the leader becomes an integral part of a three dimensional "warfighting" world of challenge, risk, and competition with clear performance goals; consistent methods of instruction incorporating individual involvement in both combat operations and subsequent AAR in virtual realities, as well as the opportunity to "try again" until the desired standard of performance is achieved. The immersion situation can be often created as a "What now, Team Commander or Vehicle Commander or Staff Officer?" requirement for quick response individual or small group action in response to a tactical situation followed by extensive AAR. Armor School courses provide useful examples of immersion.

(i) Leader Training in the Institution

In the past, immersion in warfighting has been desirable but not essential for Armor resident instruction. Current institutional instruction for Armor and Cavalry leaders draws on tactical exercises, both Tactical Tables and Situational Training Exercises, conducted on contemporary distributed virtual simulation (SIMNET) and on terrain boards trained where possible in small group instructior. The preferred locale is tactical situations actually in the field on the equipment. However, decreasing availability of OPTEMPO (Fuel, Ammunition and Spare Parts) has resulted in increasing reliance on simulation surrogates taught in the classroom. Courses are designed primarily for training at Fort Knox although Reserve variants have been prepared for distributed training. These include the Armor Officers Advanced Course-RC, the Basic Noncommissioned Officers Course-RC, and the Tank Commanders Course-RC. All are excellent courses, proven in combat in Just Cause and Desert Storm. They incorporate some immersion training techniques as immersion has been affordable in addressing AFV commander, small unit leader and staff leader proficiency to basic levels.

There is an accepted institutional requirement at Fort Knox to develop new ways to train active as well as reserve leaders. This need, combined with the existent SIMNET available for the Armor School at the Combined Arms Tactical Training Center (SIMNET-T) and development work already done on intensive distributed RC courses provides an ideal potential test bed. The infrastructure is there for technology and training development to enable highly efficient immersion training applicable to the Total Force. Implementation of increased immersion in leader training could consist of but not be limited

to the following undertaken initially at Fort Knox but then extended at a minimum to the Infantry, Aviation, and Engineer Schools for appropriate leader tasks. Possible programs to implement immersion training are:

- Upgrade the current Tank Combat Tables-Tank Tactical Tables prescribed in FM 17-12-1 to reflect demanding battlefield vignettes confirmed in Operations Just Cause or Desert Storm. Develop AFV, Section, and Platoon Tables for on-AFV execution with subsistent Tactical Engagement Simulation (MILES) and for execution in virtual simulation (SIMNET).
- Determine the most time-efficient institutional training package for Abrams/ Bradley Unit Leader (Platoon and Company) and Abrams/Bradley Vehicle Commander training to proficiency. Structure the training with repetitive interchangeable execution of the tables on-equipment and in simulation. In order to improve the overall efficiency of the training including the proficiency of the trainers and the effectiveness of the AAR, assess alternative training programs for pre-validation of leaders/trainers and for AAR design and execution. The training program should be designed for implementation at Fort Knox or an RC Battalion Training Center
- Develop Tank Company Team Tactical Tables at Coordination, Tactical Action and Reaction levels and modify as required for institutional leader training in the Armor School or at an RC Battalion Training Center. (See Enclosure A.) Structure the training with repetitive execution of the tables on-equipment and in simulation. In order to improve the overall efficiency of the training, assess alternative training programs for pre-validation of trainers and for AAR design and execution. The focus is AFV and small unit leader training to basic proficiency levels. Staff leader training opportunities are desirable.
- Validate tables through company team for SC12, CMF19 institutional instruction, modify as required for distributed training while maintaining the essential immersion.
- Incorporate the new training and technology developments in the RC Tank Commanders Course and the basic NCO course (CMF 19K) to be conducted at a RC BTC FY 93-95.

(ii) Leader Training in the Unit

As immersion techniques are introduced into the school in an effective training package applicable for leader training in units, unit leaders will respond by pushing to have their own training opportunities. Training development will have been completed for school use. Institutionalization of immersion leader training in the unit will depend on availability of the necessary training support--the actual equipment, simulators, and

simulations required to achieve immersion. Several test bed units (Battalion size although the initial focus will be AFV Platoon and Company) should be designated early. Units should be representative of the various training environments in the Guard. The same units (test and control) should be maintained during the entire evaluation period including assessment of post-mobilization training. They should be fully resourced to execute the conceptual training. Evaluation control units should be similarly well resourced to ensure valid Training Effectiveness Analyses are conducted.

b. Train in Unit Context With Complementarity of Training on Actual Equipment and in Simulation

Flexibility is required to provide complementary leader training both on-equipment and in simulation. Whether trained in school or unit, the majority if not all of the leader training should take place in a unit context and in a combat environment. Leaders are best taught experientially operating as leaders, developing both the tangible, measurable skills of fighting competence and the awareness of which skills are appropriate and when, during a fluid confusing fight--as all fights are. Training strategy development and proofing may occur in centralized institutional training designed for execution on actual terrain whenever possible to develop greater familiarity with equipment. However, there must also be recognition that upon export to the field, much of the maneuver time would be unavoidably conducted in simulation (virtual or constructive) not on actual terrain/equipment. This is particularly the case as much of the training is moved to the soldier at home or in the local armory. Also even in the school, there are many tasks so costly, dangerous or environmentally unsafe that they can be trained only in simulation.

Therefore, there is a real future premium on taking the maximum readiness advantage from on-equipment field training for leaders both in the school and in the unit and then designing the simulation training to be complementary. As this complementarity of actual and virtual reality is achieved over the next decade, it should be possible to achieve a fundamental shift in the locale of leader training. Less will be required on the ground in the school (Fort Knox or Gowen Field) as more can be done, actual and/or virtual, at home, at the armory or LTA/MTA combinations. Using new technologies to shift more effective training closer to the local armory is essential to achieving a substantial improvement in RC leader training.

(i) Leader Training in the Institution

Outstanding institutional leader training at the TRADOC School (Fort Knox for Armor/Cavalry) is constrained by terrain, availability of personnel, and OPTEMPO, which are not necessarily major constraints to RC-distributed training. RC training is always constrained by time. Since there are different constraints operating, direct translation of POI from AC to RC may not be wise. Programs of Instruction for AOAC-RC, ANCOC-RC, BNCOC-RC and the RC TCC could be reviewed and revised if necessary to intensify and compress for RC use. Target 50 percent reduction in course length. Consider replacing some existing courses--not AOB--with a Tank Commanders Course and a Small Unit Commanders Course trained entirely in a unit context in the school. Design for subsequent export to RC BTCs and potentially to home, Armory or LTA.

Intensify on-equipment training as well as simulation-based training drawing on the principles of structured training. (See Enclosure C.) If possible, without compromising the intensity and battle focus of the training, conduct the on-equipment training as it would be conducted at a unit WET, LTA or MTA site. Priority is to intensification of training, not ease of local implementation.

Conduct the training in a unit, combat operations context requiring individual leader demonstration of personal task proficiency in on-equipment tasks.

Immediately follow up on-equipment training with reinforcement on simulator/ simulation so that the leader is made aware of the capabilities and limitations of both as they could be applied in a distributed unit context.

(ii) Leader Training in the Unit

The bottom line for training of unit leaders for combat is to train them in a continuing "battle" designed so that explicit individual and collective training requirements established by doctrinal publications are met in an interactive immersion learning situation. That is precisely what the tables are designed to do. The leaders should be reinforced by leader "prep" packages before they train their soldiers as well as AAR support so that leaders learn and demonstrate competence to their soldiers. This is reinforced by providing training support which ties training on equipment training to training in simulation. More explicit requirements should be incorporated in the test unit training programs to ensure detailed evaluation.

c. Shift the Loci of Leader Training

Improved training effectiveness and efficiency permitted by use of distributed virtual realities at home and at the armory should bring units to the LTA or MTA better trained and better able to conduct essential on-equipment structured lane training. More of the "basics" should have been completed beforehand so the LTA/MTA focus can be much more intense and advanced. Then virtual realities can be used to recreate on-equipment LTA/MTA leader "combat" environments re-exportable back to garrison or armory or home for sustainment training.[1]

(i) Leader Training in the Unit

The technologies proposed for development provide a means for leaders to train in structured battle vignettes in the armory and potentially at home. This capability is available today infrequently for unit leadership and is normally associated with ARTBASS or BCTP training. Prepared during IDT with an intensive package of on-equipment and simulation-supported training, the unit leader should be prepared during IDT for much more demanding leader requirements at AT. To reinforce the intended shift, intensify IDT Commander training requirements (Tables, FCX, CFX, LCX) in the training program prepared for evaluation.

d. Train the Unit to Train (Decentralized) While Training its Leaders (Centralized) in the School

Design institutional leader training such that the act of training to proficiency in itself demonstrates "how to" conduct the training to standard at distributed locales, whether unit or regionally conducted institutional training. The objective is to develop competence and confidence in the small unit that it can conduct this training to standard. To this end, develop the schoolhouse training using the same or comparable training support to that which will be distributed regionally or locally to the small unit. For example, design the RC Tank Commander's Course at Gowen Field, Idaho, to demonstrate how to train in the unit both on actual equipment and terrain and in virtual simulation as the course is training at Gowen. Then ensure that the infrastructure (hardware, software, network) is available

---

1 The effort here is not to reduce on-equipment training. In fact, it is to increase the effectiveness of this training so vital because it develops the drive and instincts of the mobile leader married to a complex machine. Train the basics if possible in virtual simulation distributed to the home or armory where neither actual terrain nor equipment may be available so that the on-equipment time can be intense, demanding and combat-related. All hopefully possible at the LTA and MTA on a regular basis in structured training for both leader and small unit.

to permit distributed training groups to draw regularly on the quality control practices of the centralized institutional training center. And design the training so that timely internal or external evaluation is supported fully. It may be desirable to establish a feedback loop for real time AAR of locally developed "solutions" to be "assessed" by experts. Training and Doctrine Command or contingency chains of command could provide useful highly professional support.

(i) Leader Training in the Institution

RC institutional training should be made as intense as possible, more so than the corresponding AC course since the Reservist has less time available to practice his or her craft as a mounted soldier. Where possible, the increased intensity should be achieved with the same training support that the leader can expect to have in his unit. The objective is for the leader--both AFV commander and small unit leader--not only to learn his tasks but also to learn by personal example how to train with appropriate efficiency in his home unit at the armory or LTA. Ensure that the leader training includes application of the training technologies and strategies designed to provide that the trainers (subordinate leaders in the unit) are as competent to train to standard in the unit as the leader experienced in the school. Use of Abrams/Bradley Trainers with UCOFT type matrix and Instrumented AFV should assist this effort both in the school and in the unit. (See below.)

In the redesign of current school courses suggested above, restructure the RC TCC currently trained at Gowen to employ training programs and devices recommended for unit training.

(ii) Leader Training in the Unit

Discussed under leader training in the institution. The bottom line for training of leaders for battle is to train them in a continuing "battle" designed so that explicit individual and collective training requirements established by doctrinal publications are met in an interactive immersion learning situation amenable to timely internal or external evaluation. That is precisely what the tables are designed to do. They should be reinforced by leader "prep" packages before they train their soldiers as well as AAR support so that leaders learn and demonstrate competence to their soldiers. This is reinforced by providing training support which ties training on equipment to training in simulation. More explicit requirements should be incorporated in the test units' training programs.

e. Encourage Local "What Ifs"

Immersion training techniques can be complemented by encouraging local extension of the immersion "warfight" to expand the range of tasks trained thereby capitalizing on the interest of those in training both in school and in the unit. Training should be designed to draw upon a natural curiosity to "What if" by those undergoing training as leaders become emotionally involved in the training. Suggested "what ifs" and appropriate MOE should be provided to encourage self-directed personal development in greater depth at home or in the local armory. Initial work should be directed to development of high resolution leader training vignettes or "tables" with suggestions offered for extension of the fight in follow up training dependent on the training requirements of the using school or unit. These vignettes would rely heavily on constructive simulation presented on some form of distributed "window" to the virtual battlefield.

(i) Leader Training in Units

An integral part of the intensive immersion table training package is the AAR designed to increase the effectiveness and efficiency of school training and to support the local commander and trainer. The AAR package evaluated with the company team tactical tables should include suggestions as to follow on, more challenging, variations in Mission, Enemy, Troops, Terrain or Time Available (METT-T) which might be undertaken by the unit in training.

Develop "what if" follow ons focused on leader actions for the Company team-AFV commander and small unit leader. Where possible, "what ifs" should include exercises at expert levels of proficiency. In developing company team reaction tables, ensure that there are several variations, each addressing change in a factor of METT-T.

f. Chain of Command not Observer/Controller Training

Unit leader training (contrasted to institutional leader training) is designed so that the AAR and remedial training can be conducted to standard by the unit chain of command, i.e., an Observer/Controller infrastructure is not essential to quality training. In fact, it should be discouraged both to enhance leader teamwork and to reduce the support costs of leader training. The design should encourage a leader learning with his or her leader so there is shared learning--and increased bonding. Where the next higher leader or immediate subordinate is not available, the SAFOR should provide an adequate surrogate (constructive or virtual simulation).

(i) Leader Training in the Institution

Applicable to leader training in units. Institutional training gains in effectiveness by use of highly competent O/Cs. In the course of their training, they should be role models for commanders and trainers when they return to their units.

(ii) Leader Training in the Unit

The use of O/Cs or "County Fair" experts should be specifically discouraged. Training is a direct command responsibility. The challenge is to develop the training strategy and training support such that the average unit leader can train his or her subordinates in the unit in a battle context.

g. Use Drills and Tables to Train Basics

Rigorous training is a precondition to further training time compression. Excellent work has been done in crew training. The principles can be applied to leader training. For example, the matrix methodology of UCOFT can be transferred to leader situations by defining floor levels of proficiency. That is, create individual leader "tables" permitting self-paced individual development to basic and advanced and perhaps on to mastery levels of proficiency in critical leader tasks where procedural coordination "drills" are involved such as tactical reports or call for fire from the AFV commander or at a higher echelon for the unit commander. The present tank tactical tables offer specific examples for vehicle and small unit leader proficiency. (See Enclosure A.) Up at battalion or brigade echelon, there are clear coordination responsibilities required between S-3, S-2, and Fire Support Officer to provide effective counterfire, which itself is measurable--rounds on target on time. Selection of thoughtful Measures of Performance for battalion tactical tables will develop useful cues for training in leader or battle command/staff training in these kinds of tasks.

The most time and dollar efficient "field" training for leaders on the equipment is in a structured unit combat context (in a quasi-unit created if necessary for leader training in the institution) undergoing multiple lane training situations--either tables or STX. This has been done in the past in Fire Coordination Exercises (FCX) on micro terrain by substituting subcaliber devices for full caliber weapons. No major change is foreseen for full up Combined Arms Live Fire Exercises which remain necessary at the various echelons. Opportunities to pretrain leaders in the existing tank combat tables in virtual realities are implicit in the discussion of small unit collective training (tables and STX). The training challenge would be to distribute these tables for implementation on equipment or in

simulation without loss of the rigor of the training requirement and without stifling the competitive challenge as the training experience is routinized.

(i) Leader Training in the Institution

Existing and proposed tank combat tables are adaptable to institutional leader training as discussed above. These could be complemented by extension of the training strategy embedded in the Abrams/Bradley Conduct of Fire Trainer (COFT) in the training matrix. The matrix diagnoses vehicle commander/gunner proficiency then prescribes a series of training exercises of increasing difficulty until desired terminal proficiency is attained. This methodology could be expanded for reserve force use in the armory or local training area:

- Develop a COFT-type driver training matrix for an Abrams Trainer (see below).
- Develop a COFT-type tank commander SL3 Training Matrix for an Abrams Trainer.
- Develop a platoon COFT-type small unit training matrix for multiple netted Abrams Trainers.

h. Design Training to Encourage Competition

Immersion can create intensity of training in virtual simulations comparable to the equivalent training environment of CTC-NTC Force-on-Force training as a result of intense personal involvement which the simulation stimulates from most leaders. As a characteristic of distributed simulation, complex events can be recreated easily. The simulation is reinitialized at any point in time or space. This capability enables fair competition where different leaders can be presented precisely the same military situation and their response assessed in great detail. Positive competition can accelerate "crawl, walk, run" in leader training.

Competition can be to attainment of standard on a very demanding table--one of the reaction exercises which has been automated for all but the leader--or it can be in response to various possible "what if" vignettes prepared for competitive use.

(i) Leader Training in the Unit

The purpose is to increase intensity and personal involvement through productive competition among and between AFV Commanders and small unit leaders. Various tables

can be tailored to stimulate leader competition. In conjunction with the development of the company team tables proposed above, it may be useful to design several reaction tables such that they can be used to assess the utility of encouraging competition between RC leaders in institutional training.

i. Encourage Supportive Unit (Leader) Policies:

Lastly, effective leader training in both school and unit is enabled by supportive policies and chain of command actions designed to demonstrate strong positive and negative incentives to train well. The most critical element of support for leader training is the attitude of other leaders, particularly the senior leaders. If they are concerned about their proficiency and demonstrate that proficiency by example, all leaders will pursue intensive self development programs. The Battalion Commander who is the first to qualify his AFV on the gunnery tables will have no difficulty encouraging subordinate leader training. The magnitude of change anticipated in intensified immersion training will be very difficult to achieve by technology and training strategy alone. Other incentives to stimulate the will of leaders to improve should be integral to the overall leader training program.

2. Distribution

Intensified reserve leader development is supported by distributing the training to the lowest leader echelons through:

a. Distribute Training to the Lowest Feasible Echelon

Leader training should be designed to be executed at as many alternative sites as possible. Initial efforts should focus on institutional training distributed from centralized national sites to distributed regional sites. Then the training should be further distributed to units, initially battalion then company echelon, finally to the individual leader at home or business site if that is restablished as an effective training locale. The priority should be for small unit leader training, then AFV commander, and then staff training. The distribution development sequence should be to prove the training strategy and new technology in a centralized facility then proliferate as field units see it and want it and as the technology becomes more capable and less costly.

Current practice distributes simulators and simulations to the RC as part of a total force distribution plan. The RC plan often appears to duplicate the AC plan for both leader

and small unit training despite a vastly different RC unit training environment. This assumed parallelism should be questioned as major compression of RC training is contemplated.

The need and capability to distribute leader training is increasingly self evident. The Reserves are distributed. Evolving technology is absolutely supportive. The issue is not "if," it is "how much." How much is desirable and then how much is feasible? Training development will answer the first; technology and resource availability will answer the second.

Appropriate policy for leader training in units is a genuinely complex issue. The problem is the availability of time given the competing demands of individual and small unit training in the average RC unit. The answer for the AFV Commander is self evident. Presumably he has attended the schoolhouse vehicle commanders course to achieve basic vehicle proficiency. As he trains on rigorous COFT-like matrices and operates in a fast-paced combat environment in simulation at the armory, and is subjected to good AAR, positive leader training is occurring at least to a basic proficiency level--all that we expect prior to mobilization.

The situation seems similar for the small unit commander. As already discussed, for at least the next several years, the preponderance of unit command leader training should occur with rigorous quality control in the school. However, the exercise of command in a "warfight" is demanding leader training, for better or worse. As the AC discovered at the combat training centers, the crucible of battle sorts the competent from the incompetent. The commander who consistently loses his force in "battle" rapidly loses his credibility to his subordinates. Therefore it would appear to be virtually a moral obligation of the Guard senior leadership to provide self-improvement leader training opportunities to small unit leaders as they are "fighting" in the armory and LTA. This leader training support should be made available at least in the local armory and if possible in the leader's home if that is what he or she desires.

The AC leader is reinforced by his chain of command immediately available to correct and counsel in tactical briefbacks prior to mission execution. Since there is little of this reinforcing leader competence immediately available for the RC small unit leader as he trains in his armory, the simulation will have to be designed to compensate. If "fighting" is not a satisfying, reinforcing experience during IDT, small units will find other less productive use of their time. That is human nature. So distribution of leader training

support--pretrain for commanders prior to execution of tables and STX or AAR support so the commander can conduct the AAR himself--is not just desirable. *It is essential.* It is a precondition to the conduct of compressed distributed training. The bottom line is that for intense effective training to occur at small unit armories, training support must be provided to a much greater degree than that required for the AC. The primary leader training locale remains the school; however, the unit is a close second and as discussed should supplant the school over time.

The degree of decentralization of training support for leader training should be determined by test. As company echelon training programs are developed for evaluation, one alternative should centralize leader training support at battalion with on-call availability to companies. Another alternative should maintain the training support at the company.

Battle staff leader training is a different problem. Here training support would appear desirable in the home or place of work--whichever is more conducive to self-study. Team or collective staff training would occur at the battalion or brigade headquarters armory. Since staff training (Command Field Exercises, Command Post Exercises) would occur less frequently, regional centralization of simulations seems appropriate.

In effect, leader training situations are distributed to the locale best suited for effective learning. In general, for the RC, distribute as close to the home/place of work of the individual as possible--actual equipment to the small unit armory, simulation virtual realities to the home or the most convenient locale for small groups to assemble to train. Design to use common CTC or MTA terrain so that a performance tie is established from performance on the ground with actual equipment to comparable performance in simulation. The essential characteristic is flexibility of the training strategy to varying local capabilities and requirements generated by the chain of command.

(i) Leader Training in the Institution

In the case of leader training in the schoolhouse, the cost of training and the need for stringent quality control have resulted in centralization of training. Fort Knox and Gowen Field, Idaho, are current major training sites with growing potential in the Southeast where priority units can draw on AC simulation capabilities (Fort Hood, Fort Stewart). At a minimum, RC Battalion Training Centers should be considered for unit command and AFV commander courses recommended above.

As institutional AFV and small unit leader training is decentralized, develop digitized terrain of the regional MTA so that both on-equipment and on-simulation training exercises are fought on the same terrain.

(ii) Leader Training in the Unit

Basic distributed leader training is already feasible. The current Mobile SIMNET can provide outstanding tactical leader training today drawing on techniques developed at Fort Knox. AFV commander and staff training opportunities will come with the various devices proposed in this study. Resource feasibility can be determined only after a Training Effectiveness Analysis, which should accompany all proposed training strategies and training support.

b. Incorporate Low Cost Consumer Electronics

Distribution is facilitated by use of low cost consumer electronics capable of contract "Radio Shack" local repair. Hardware should be highly portable not only to support changing local requirements but also so that it can be concentrated for priority peacetime training requirements as well as pre- or post-mobilization training to the METT-T of contingency operations. Also it should be capable of very flexible low-cost networking to permit leaders to "assemble" routinely by telephone or cable "conference call."

(i) Leader Training in the Unit

Establish design to cost development criteria. Require local maintenance of training support used in the test program.

3. Modernization

Intensified reserve leader development by creating new technology applications to:

a. Develop Flexibility of Echelon, Locale, Means and Application

Simulation should be highly flexible as it responds to various training audiences. Flexibility should take several forms:

- Flexibility of echelon (platoon to brigade) and battlefield operating system (Maneuver, Fire Support, Command and Control, etc.) which can be represented in distributed simulation.
- Flexibility of locale such that the leader can train in distributed simulation from home to RC Battalion Training Center as he or she desires.

- Flexibility of means such that the leader can train virtually interchangeably on a simulator integrated into distributed simulation, on actual equipment or on a home-distributed simulation display which has been instrumented to port the leader on to the virtual battlefield.
- Flexibility of application to permit practicing the above as an individual leader or in a small leader group in a variety of locations--official or private, including homes. The simulation permits training as self plus all others represented by SAFOR similar to playing Solitaire or computer games (constructive simulation). For example: the current UCOFT provides an excellent capability for highly structured training distributed worldwide with quality assured by the design of the training matrix. As currently fielded, limited discretion is permitted an Instructor/Operator who must be present to set up and control the training situation. In general, both vehicle commander and gunner are required to "fight" the AFV. Future modification should increase the flexibility provided the chain of command such as enabling training of either vehicle commander or gunner with the other and/or the I/O represented in Semi-Autonomous mode.

Another alternative for leader training could be self plus several others plus SAFOR or similar combinations where the mix of actual equipment and simulations/ simulators can be varied to suit the training audience in a hybrid simulation which mixes actual equipment and simulators and simulations practically interchangeably. For example, assume that Captain X wants to practice his proficiency commanding a company team in a Movement to Contact mission as preparation for a performance evaluation on this mission in his RC Armor Officers Advanced Course. The simulation will create a terrain battlefield (virtual reality) of his choosing--presumably the same terrain his performance evaluation will be on at the regional RC Battalion Training Center or Combat Training Center. If he desires to train by himself at home, his subordinate platoons, flank units, higher Battalion and the enemy are all represented by SAFOR (constructive simulation) as he executes tables. Alternatively, concerned about his ability to employ fire support, he asks another student living nearby to be his FIST, and they practice different combinations of direct and indirect fire in tables (an *ad hoc* Fire Coordination Exercise) from a terminal in his home. All other participants are SAFOR. Finally, uneasy about his ability to actually command from a moving tank, he sets up a visit to a local Weekend Equipment Training Site on a weekday evening. While Full Time Technicians act as his crew, he refights the tables above from an instrumented command tank. All other participants are SAFOR. For all of these training exercises, he is provided an "automated" AAR evaluating his performance by

preagreed Measures of Effectiveness or Performance within 15 minutes after completion of the table.

This example describes small unit leader training. Similar possibilities should exist for AFV commander and battle staff member.

(i) Leader Training in the Institution

Flexibility of echelon: Develop the unit combat tables so that if the institutional focus is at platoon leader training, company and battalion can be semi-automated or automated (constructive simulation). Same at other echelons. That is, if the focus is at company, platoon and battalion can be semi-automated or automated.

Flexibility of means: Design course POI so that actual equipment or distributed simulation can be used interchangeably for all but on-equipment live fire tasks.

Flexibility of application: If possible, design the leader course POI so that the same bloc of instruction can be used for both AFV or small unit leader training and for small unit training. Design so that the instruction can be conducted with a variable mix of actual equipment and simulators/simulations--manned, semi-automated, or automated all on the same terrain--real or digitized.

b. Improve the Resolution of Virtual Realities

Improve virtual realities. Enhancement of the visual presentation seems an inevitable requirement. The challenge is "how much is enough?" or, more realistically, how much is necessary to cause the essential behavior cues to be present? The training benefit of the technology is influenced greatly by the quality of the cues in the virtual battlefield presented to the leader. Initial improvements to support leader training should apply to centralized training locales, but ability to distribute inexpensively locally to individual homes should follow as a development goal.

Improvements are required in both resolution and timeliness of changes. Resolution should be appropriate to individual vehicle (AFV) and Infantry Squad levels all weather, all visibility. There should be comparable resolution for cues in other battlefield operating systems. Part task leader training may be necessary when the training is to be distributed to the armory or home. The determinant will be the unit cost of the training support. It must be affordable if it is to be widely distributed. This is a critical issue which must be evaluated by Training Effectiveness Analysis. In addition, terrain should be

dynamic to AFV level of resolution. That is, reflect sufficient detail to impact on single AFV capability. The terrain data base should be tailorable to local requirements in 30-60 days.

The quality of the representation itself should be improved in a phased program. The technology development should be directed at improving the ease and timeliness of remote direction of constructive simulation and the quality of the visual cues presented to the leader. Three-dimensional representation should be an eventual capability.

(i) Leader Training in the Institution

The general requirement was defined under "Modernization," above. These technology developments should be programmed for sequential incorporation in institutional courses conducted at an RC Battalion Training Center. Suggest use of Gowen Field, Idaho, for this effort. There is a record of quality institutional training combined with the ARI Evaluation Cell at the University of Boise. A SIMNET-T facility could be established at Gowen Field with at least one company of Abrams, one company of Bradleys, and a battalion command group supported by appropriate training support, such as Data Logger and Stealth.

(ii) Leader Training in the Unit

The general requirement was defined under "Modernization," above. These technology developments should be programmed for sequential incorporation in unit-based leader training conducted in a test unit.

c. Provide Improved Networked Simulation (Freestanding and Appended to Actual Equipment):

Improve the force-on-force portion of on-equipment training for leaders presently conducted using Tactical Engagement Simulation. Proposed stages of development for force-on-force leader maneuver training capability are:

- On equipment, on lanes using MILES (Current).
- On instrumented equipment on lanes using improved subsistent Tactical Engagement Simulation (reflecting time of flight, etc.) in a hybrid environment. Units on the flanks are in simulation unobservable to actual units maneuvering on the actual terrain. However, other units fighting in virtual realities can "see" the instrumented equipment fighting.

- On instrumented equipment moving on lanes (or stationary in the Armory, WET Site, or MATES) fighting interactively with manned and unmanned vehicles and units operating in virtual realities. This is training in a hybrid mode for combat arms, i.e., crewmen in vehicle on the ground moving but seeing simulations (virtual realities) in vision blocks or when out of hatch.

A potential example of this modernization objective could be training a small unit commander who is in his combat vehicle--cold, wet, tossed from side to side as his vehicle maneuvers across representative (difficult) terrain at a WET site--observing through his vision blocks the rest of his company executing several STX under his command but all in virtual reality in constructive simulation on appropriate digitized terrain. This would be a final performance evaluation in the RC Armor Officer Advanced Course.

(i) Leader Training in the Unit

Instrumented M1. Permit actual M1 to come up on the distributed simulation "net" as a SIMNET (CCTT) M1--observed by others on the distributed net as an M1 moving properly on "SIMNET" terrain. Initially, actual tank can see only other actual tanks, eventually need the ability to interact fully with objects in distributed simulation. That is, observe objects in simulation through vision blocks, "fire" on vehicles or aircraft in simulation using full fire control of actual tank, "drive" the actual tank on the SIMNET terrain.

Abrams Simulator/Simulation (Abrams Trainer). Develop an all-purpose distributed simulation cabinet (Abrams) capable of presenting an appropriate training matrix (similar to the current UCOFT Gunnery matrix) to the TC (TC Matrix), Gunner (Existing UCOFT matrix upgraded for degraded, long-range gunnery, etc.), or Driver (Driving matrix) either in an interactive mode (like the TC and Gunner on the current UCOFT) or for one crewman with the other crew members represented semi automatically. Loader requirements to be determined. The cabinet would train critical part tasks with appropriate behavior cues to cause the crew member in training to progress in the appropriate matrix individually or in combination with the other crew members. The cabinet should be portable so that it could be moved from armory to armory on military truck, with some ruggedized so that they could be operated reliably in a CTC or RC Regional Training Center field assembly area. The cabinet should be capable of being networked locally and long haul with other AFV cabinets. The simulator would be designed to train to the part task gunnery table VIIIX discussed in concept on pp. III-12 and V-9.

Commander-Staff Trainer. Much of the necessary leader training, particularly in the unit, could be undertaken at the armory, at home, or in the civilian workplace if there were a means for individual entry into the virtual battlefield. The Commander-Staff Trainer is just such a device. Possible stages of development could be:

a. Virtual battlefield on a dumb TV screen in the home. Can observe action and respond to cues but not influence the fight directly.

b. Virtual battlefield on an interactive home TV screen. The user can direct SAFOR "fighting" and observe passively from a Stealth at pre-agreed vantage points.

c. Virtual battlefield on an interactive home TV screen. The user can command SAFOR or manned vehicles from his home workstation "AFV" or move at will in a Stealth mode. AFV to Battalion echelons. High resolution terrain Limited Data Logger capability.

d. Capabilities of b., with three-dimensional representation. Holography in home?

e. Capabilities of c., with three-dimensional representation. Parallel development should apply to the AFV commander and battle/staff leader.

Porting the virtual battlefield to permit interactive personal action with all other objects in constructive simulation (Stage b., above) should be an early Commander-Staff Trainer development objective. Design the trainer to permit a company commander to fight his unit on a company reaction table in constructive simulation from a distributed location.

d. Create New Leader Training Exercises

Enable new forms of experiential training exercises-living history and battle conditioning. Modernization should permit the creation of "living history" as a powerful tool in leader training. Imagine a tough actual combat action recreated in virtual simulation with the capability to "insert" a trainee leader into the battle at various times to assess his ability contrasted with that of the actual combat leader. Then the AAR could compare the actual results of the combat action with those achieved by the leader in training.

For example, assume distributed simulation "replay" of the combat actions of G Troop 2 ACR 25-26 February at 73 Easting in Iraq during Desert Storm. You enter a platoon leader's tank and observe the battle from that platoon leader's perspective second by second as it occurred--direct, indirect fire, movement, Iraqi actions round by round. Then at a critical point, take command of the platoon. Can you do better than the actual

platoon leader did in February 1991? Be advised as you move or employ direct or indirect fire other friendly and enemy actions will change accordingly!

Lastly, virtual realities should be amenable to structuring to create intense battle conditioning experiences. Ex: AFV battle shock-noise, confusion, trauma of direct/ indirect fire exchange, on board KIA/WIA.

(i) Leader Training in the Unit

DARPA, ETL, IDA, Chief of Military History and Fort Knox are teamed to develop "living history" in Advanced Distributed Simulation drawing on experiences on Desert Storm. Vignettes from this battle should be tailored for both small unit leader and AFV commander training. After validation at the Armor Center, the training should be provided for a unit leaders course and an AFV commanders course (discussed above).

Operation Desert Storm training indicated a need for greater RC leader familiarity with his equipment as a mounted warrior. Structured on-equipment training has been traditionally associated with unit training. New structured training exercises need to be created to develop more extensive AFV commander familiarity with his fighting vehicle. On-equipment training should be structured so that the leader has frequent maintenance, pre-combat checks, and general living on the equipment. This increased exposure should be incorporated in the revised leader courses discussed above. Ex: more time living on the equipment executing common battle tasks, less time in barracks during WET or MTA/AT training.

4. Prioritization

Intensified reserve leader development by prioritization of training requirements to:

a. Train "Levering" Battle Tasks

Design leader training to train only levering battle tasks for the RC. The entire focus and locale of leader training should be the unit at war--fighting likely battles. Not the unit "at peace" in garrison performing State missions. This is a responsibility of the National Guard.

The National Training Center conducted an extensive contingency battle analysis in designing the training program for the round out brigades during Operation Desert Storm. The Mission Essential Task List was modified and reduced considerably. The leader training tasks deemed critical by the NTC should be included in the test training programs.

b. Institutional Training Priority for Leader Training

For the near future, conduct the majority of critical leader training in the institution. As leader proficiency improves, distribute the capability and responsibility for leader training as low as possible but when distributed do so with the rigor and quality associated today only with the institution. Training to standard with frequent internal and external evaluation is essential.

Institutional leader training is not intrinsically more important than unit leader training. Quite the reverse. However, the magnitude of the problem of in-depth leader competency is so pervasive, as it was for the AC after Vietnam, that a major increase in effectiveness and efficiency--tough training absolutely to standard with frequent evaluation--is essential. This can be done more rapidly in the institution than in the unit. Also, serious examination of training alternatives, leader and small unit, all incorporated into a "doable" annual or biannual training program, is required before unit training decisions are made. For all these reasons, leader training improvements should start in the institution.

V. EXECUTING THE VISION

Unified conceptual direction will provide focus for major change but the "bottom line" can only be satisfactory small unit and leader training conducted routinely in the field. Recall the objective is to develop and design a new simulation-based intensified training readiness strategy for the Reserve Component intended to create an order of magnitude improvement in the effectiveness and efficiency of Reserve Forces training. The development strategy is to combine new simulation technology and an intensified training strategy to achieve the change. Having selected levering areas for intensive development, the next challenge is to translate general training and technology development guidance to implemented reality. Both training strategy and training support should incorporate: (Concepts described in detail Chapter II)

Compression

- Immersion in warfighting
- Train in unit context with complementarity of training on actual equipment and in simulation
- Shift the loci of training
- Train the unit to train (decentralized) while training its leaders (centralized) in the school
- Encourage local "what ifs"
- Chain of command not Observer/Controller training
- Use Drills and Tables to train basics
- Design training to encourage competition
- Encourage supportive unit policies

Distribution

- Distribute training to the lowest feasible echelon
- Incorporate low cost consumer electronics

Modernization

- Develop flexibility of echelon, locale, means and application
- Improve the resolution of virtual realities
- Provide improved networked simulation (freestanding and appended to actual equipment)
- Create new training exercises

Prioritization

- Train "leveri..g" battle tasks
- Institutional training priority for leader training.

The task now is to translate it all to an action program which will stimulate and focus coordinated, integrated development and evaluation across the Guard. Six major National Guard program areas are suggested to focus the development. They are: Commander Staff Trainer, New Training Exercises, Structured Training Programs, Distributed Training, Instrumented Abrams/Bradley and Abrams/Bradley Trainer. These six areas are structured to facilitate National Guard leadership control of the design and execution of the overall program so that the diverse training needs of the Guard are met. Coordination with DARPA and the scientist is a separate problem which will be addressed in the next chapter. A three phase program could be as follows:

Phase I	Design of an Advanced Technology Training Strategy FY 92-93.
Phase II	Insert Advanced Simulation Technology, Train and Assess FY 93-95.
Phase III	Expand to Brigade, Train, Mobilize, and Assess FY 96-97.

A. COMMANDER-STAFF TRAINER

1. Concept

In order to advantage the training potential of virtual and constructive simulation, warfighters need ready visual access to the battlefield so that they can interact with other leaders, staff officers or subordinates in their units from the armory and eventually the home. The view should be represented as the view from TC vision blocks on the Abrams or Bradley, from a HMMWV, or from a ground location for the light infantryman. The Trainer should be low cost with resolution sufficient for battle command/staff training cues, and easily movable from armory or home.

Objective: To achieve distributed leader task training effectiveness using virtual Tactical Engagement Simulation equal to that achieved by application of the same technology in concentrated sites (SIMNET-T at present).

2. Application

Support brigade and battalion staff training and evaluation on Battle Command/Staff Tables in CFX, CPX or STAFFEX mode in virtual and constructive simulation.

3. Evaluation

Training Effectiveness Analyses. Two Battalion Task Forces, one light, one heavy, utilize to train prior to CTC or RC BTC training. (Two Bn Sets @ 8 Trnrs--1/Command Group, TOC, ALOC, and Company Commander) FY 93 Two Brigade Task Forces, one light, one heavy, train Battle Command/Staff Tables FY 96.

B. NEW TRAINING EXERCISES

1. Concept

Extend the current Tank Combat Tables to Company Team and Battalion Task Force for both live fire tables and tactical tables. The tactical tables should be capable of execution by both the Abrams/Bradley Trainer and the Instrumented Abrams/Bradley or the Commander-Staff Trainer as appropriate, either in fixed site or mobile training area operations netted by local or long haul networks. While the primary focus is on tactical tables, gunnery tables should also be reviewed to establish a requirement for part task training conducted on the Abrams/Bradley Trainer and the Instrumented Abrams/Bradley in the Armory or LTA. Convert the combined arms heavy tables to combined arms light. Light forces tables should represent infantry to the squad level with leader access on the ground, from a HMMWV, or from an aircraft.

Conceptual development of both light and heavy tables should include the development of train the trainer modules designed to train the chain of command to conduct the tables and AAR to standard themselves without reliance on Observer/Controllers. Prepackaged After Action Reviews will be provided to predetermined Measures of Performance for the tables.

After the tables are validated at the combat battalion echelon (battlefield operating system representation), expand the tables to artillery battalion, engineer company, ADA battery and CSS at Brigade echelon.

Objective: Tables executed with subsistent and/or virtual simulation in conjunction with ancillary training support material provide equal or better training effectiveness in less time (50 percent reduction) than existing on-terrain training exercises in training to Proficiency Gate: Mission Training Plan Standards on Mission Essential Task List Tasks.

2. Application

Initial heavy company table development under way at Fort Knox. Complete heavy company and battalion echelon tactical tables and supporting train the trainer and AAR modules FY 92-93. Convert to light infantry company and battalion in FY 93-94. Extend to Combat Support and Combat Service Support in FY 94. Incorporate into institutional and unit training for test units and courses in extension of FORSCOM Bold Shift in FY 93 and 94. Extend tables to brigade echelon FY 94-95.

Modify heavy force combat tables to provide more intensive compressed training based on the training experience with the Instrumented Abrams/Abrams Trainer FY 95. Incorporate revised tables into institutional and unit training FY 96.

3. Evaluation

Training Effectiveness Analyses. Detailed assessment of company then battalion tables as they are applied to new type units. Implementation of the FORSCOM Bold Shift training initiatives to improve the training readiness of the Round Out Brigades should provide an opportunity to evaluate selected prescriptive structured training exercises beginning in FY 92.

C. STRUCTURED TRAINING PROGRAMS

1. Concept

The training exercises described above, when combined with the numerous other exercises currently available, will provide opportunities to change significantly the process of training. IDT and AT training programs can be made considerably more compressed. Professional development courses can be affected. At a minimum, the Basic NCO Course

and some equipment training courses such as the RC Tank Commanders Course can be made more comprehensive.

Objective: 50 percent expansion of content for current institutional courses or unit training programs in existing time and 25 to 50 percent reduction in time required to train to objective task proficiency.

2. Application

Restructure current unit and institutional training to intensify employing advanced simulation and new training strategies for assessment at appropriate training locales.

3. Evaluation

Training Effectiveness Analyses. Develop compressed training programs for light and heavy force companies. Execute heavy and light force company intensified training at armory, LTA, MTA, RC-BTCs FY 93-95, battalion TF--light and heavy--FY 96-97 including a mobilization training evaluation at the CTC:

- Equip RC-BTC with a SIMNET-T capability (cabinets for BnTF Command Group and TOC, one Abrams Company, one Bradley Company) FY 93-94.
- Redesign RC TCC to advantage intensive immersion training FY 93, 94; incorporate Mod 1 Abrams FY 95, Mod 3 Abrams FY 96.
- Redesign RC BNCOC CMF 19 and 11 to advantage intensive immersion training FY 93,94; incorporate "living history" vignettes FY 94, Mod 3 Abrams FY 96.

D. DISTRIBUTED TRAINING

1. Concept

Extend existing distributed simulation to the armory then into the home or civilian work place for training in virtual or constructive simulation.

Objective: Distribute networked virtual or constructive Tactical Engagement Simulation supporting Abrams/Bradley Trainers, Instrumented Abrams/Bradley or Command-Staff Trainers to the Armory or home as appropriate at costs comparable to home cable distribution in 1991.

2. Application

Construct digital network infrastructure connecting armories with each other and higher command locations, and with other network assets (RC BTC, netted OPFOR) FY 93-95.

Expand the network, add modified simulator modules and capabilities, add improved network services, prototype and assess portable personal modules FY 96-97.

3. Evaluation

Proofs of Principle. Distribute in coordination with the assessment schedule above. Integrate in evaluation of the Structured Training Programs described above.

E. ABRAMS SIMULATOR/SIMULATION (ABRAMS TRAINER-BRADLEY TRAINER)

1. Concept

Develop an all-purpose distributed simulation cabinet initially for Abrams and Bradley, then other systems (TOW) as required. Cabinet capable of presenting an appropriate training matrix (similar to the current UCOFT Gunnery matrix) to the TC (a new TC Matrix), Gunner (Existing UCOFT matrix upgraded for degraded, long range gunnery or other Desert Storm Lessons Learned) or Driver (Driver Matrix) either in an interactive mode (like the TC and Gunner on the current UCOFT) or for one crewman with the other crew members represented semiautomatically. Loader requirements to be determined.

Objective: Cabinet would train selected part task critical individual crewman tasks at the appropriate skill level with appropriate behavior cues to cause the crew member in training to progress in the appropriate matrix level of proficiency individually or in combination with the other crew members. The cabinet should be portable so that it could be moved from Armory to Armory on military truck, ruggedized so that it could be operated consistently in a Combat Training Center or RC Regional Training Center field assembly area. Cabinet should be capable of being networked locally and long haul with other AFV cabinets. Objective unit cost: $200K per cabinet in volume production. Upgrade existing mobile SIMNET M1 to current UCOFT matrix training capability (Mod 1). As a parallel effort, distribute the SIMNET battlefield to the existing fielded UCOFT trainer FY93. Develop a part task TC and Driver Matrix, provide in two platoon

sets of Abrams Trainer for portable armory use (Mod 2) FY 94. Ruggedize one additional Platoon set for CTC or RC BTC use (Mod 3) FY 94. Same sequence for Bradley one year behind Abrams, i.e., Mod 1 FY 94, Mod 2 FY 95, Mod 3 FY 95.

2. Applications

Initial: AFV Combat Tables. AFV tactical tables and part task pre and post live fire gunnery training at crew, section, platoon, and company levels. Subsequent: Appropriate institutional courses, small unit training and staff training.

3. Evaluation

Training Effectiveness Analyses. Company execute tank combat table training (gunnery and tactical tables) employing Abrams Trainer Mod 1 at Armory FY 94.

Two companies execute tank combat table training (intensified gunnery and tactical tables) in Mod 2 platoon sets at armory; battalion use Mod 3 at RC BTC FY 95.

Two battalions execute tank combat table training to company echelon using two platoon sets of Mod 2 Abrams Trainers, two sets of Command-Staff Trainers and One company set of Instrumented Abrams (see above) FY 96.

Incorporate Mod 1 Abrams in RCTCC FY 95; Mod 3 Abrams remain at RC BTC for use and evaluation FY 96.

Same evaluation sequence for Bradley-equipped units.

F. INSTRUMENTED ABRAMS/BRADLEY

1. Concept

Permit actual Abrams or Bradley to enter the distributed simulation "net" as a SIMNET (CATT-compatible) AFV-observed by others on the distributed net as an AFV moving properly on virtual terrain. The training resolution of the instrumentation should be sufficient to permit execution of selected platoon and company echelon combat tables and STX on the actual equipment interacting with other AFV or units on the ground or in virtual simulation. Initially (FY 94) actual AFV can be seen on a distributed simulation battlefield but it can see only other actual AFV. The objective is ability to interact fully with objects in distributed simulation (FY 95). That is, observe objects in simulation through vision blocks, "fire" on vehicles or aircraft in simulation using full fire control of actual AFV,

"drive" the actual AFV on the virtual terrain. Required level of resolution for part task training to be determined by Training Effectiveness Analysis. Objective unit cost: less than $200K per instrumented AFV when in volume production.

2. Applications

Equip test platoon-size unit FY 94, company-size unit FY 95. Follow up with Instrumented Bradley in test unit in FY 95.

3. Evaluation

Training Effectiveness Analyses. Platoon of instrumented M1 executes part task platoon gunnery tables (CALFEX or Table XII) on the ground visible in seamless simulation to the higher company team "fighting" on the flanks in distributed simulation on the same terrain. Platoon at RC Battalion Training Center, company at Armory FY 94 .

Platoon of Instrumented Abrams executes company tactical tables in seamless simulation with a company team(-) in distributed simulation. The company team is conducting company tactical tables on virtual terrain with one of the subordinate platoons in tanks actually moving on the ground. Each sees the other and interacts as if all were on the ground or all in simulation Platoon at Local Training Area, Company at Armory FY 95.

Company of Instrumented Abrams and Bradleys on the ground executes a Fire Coordination Exercise and a company tactical table in seamless simulation with the next higher Battalion Task Force(-) present in distributed simulation. Company at RC BTC, battalion at armory FY 95.

Battalion conducts a Command Field Exercise in seamless simulation at a Major Training Area. Key leaders in actual instrumented Armored Fighting Vehicles maneuvering on MTA terrain, all others in simulators or represented by semi-automated forces (SAFOR) FY 96.

G. SUMMARY

It is difficult to establish precise objectives for each of these six National Guard program development areas. Some can be delineated in detail only after Training Effectiveness Analyses. For example, the Abrams/Bradley Trainer is to be a part task trainer. Only tasks absolutely critical for monthly training should be enabled in order to keep costs down and thereby assure distribution to the local armory on a continuous basis.

This latter requirement effectively mandates at least one company set per AFV Battalion. Presumably the FORSCOM AFV Combat-Gunnery Table objective is at least crew level proficiency on Table VIII annually at an AT MTA (RC BTC?). Given this, the annual gunnery training program should consist of both IDT and AT training. What is trained at the Armory monthly during IDT? Whatever it is (call it Table VIIIX), that proficiency must be supplemented by task training at AT prior to firing Table VIII. What is Table VIIIX? That is a new way of looking at the design of tank combat tables based on the reserve environment rather than the availability of ranges, etc., assumed in the current tables designed for the active units. Training Effectiveness Analysis will be required to determine what Tables VIX, VIIX and VIIIX, all designed for monthly armory training, need to include. Is visual resolution to only 1,000 or 1,500 meters permissible for distributed armory training knowing that pre Table VIII AT training (Table VIIY?) must include target acquisition and engagements out to 3,000 meters? That decision alone could reduce simulator costs dramatically. Specific requirements for the low cost Abrams/Bradley Trainer cannot be determined until the Proponent provides this kind of guidance.

In addition to the training and training development requirements derived from this action program, there is a broader list of DARPA Requirements Development Tasks necessary to enable the training and readiness concepts. Some of the currently known development tasks are indicated in the next chapter. They will all evolve, however, as the training requirements mature. That is the pacing function here. What is best for the small unit, leader and staff? Repetitive trials in units should ensure integrated development, which is essential to achieve the ambitious goals.

A summary of requirements to enable the action program is shown as Figure 3. A possible schedule of trials--Proofs of Principle and Training Effectiveness Analyses--is shown as Figure 4. Distributed training is not included as a separate category because all of the other trials will involve distribution. Overall coordination and program direction with DARPA is discussed in Chapter VI. In all cases, hardware test and evaluation follows the training development and should be supported by training development previously executed and evaluated in unit training.

HARDWARE					
FY 92	FY 93	FY 94	FY 95	FY 96	FY 97
Instrumented Abrams/Bradley					
		4 Abrams	10 Abrams		
			4 Bradley	10 Bradley	
Abrams/Bradley Trainers					
Abrams	4Mod1	3Mod2, 4Mod3			
Bradley		4Mod1	8Mod2,4Mod3		
Commander-Staff Trainers					
	16			48	

SIMNET +					
FY 92	FY 93	FY 94	FY 95	FY 96	FY 97
	Mini SIMNET T RC-BTC		Total New Simulators:160		14 Instr Abrams
	18Abrams 18 Bradley				14 Instr Bradleys
	NOTE: Incl in Trnrs			34 Abrams Trnrs	
					34 Bradley Trnrs
					64Cmd/Staff Trnrs

TRAINING DEVELOPMENT					
FY 92	FY 93	FY 94	FY 95	FY 96	FY 97
	Abrams/Bradley--Matrix for TC, Gunner,Driver				
	Co, Bn Combat Tables(Lt&Hv)		Bde Combat Tables		
		Extend Tables to CS,CSS.			
			Revise Plt,Co,Bn Combat Tables		
	Revise RCTCC				
	Revise BNCOC-RC CMF 19, 11				
Revise RC Training Program					
	Co (Lt&Hv)Trng Programs			Bn TF(Lt&Hv) Trng Programs	
Design Evaluation				Revise RC Training Program	
Functional Descriptions Required:					
FY 92	FY 93	FY 94	FY 95	FY 96	FY 97
	Instrumented Abrams and Bradley				
	Abrams Trainer Mod 1,2,3.				
		Bradley Trainer Mod 1,2,3.			
	Commander-Staff Trainer				
	Battlefield Operating System-Bn, Bde, Manual and SAFOR.				

NOTE: Left margin is Start Year
Much of the FY 92 Training Development is under way in FORSCOM Bold Shift.

Figure 3. Summary of Requirements

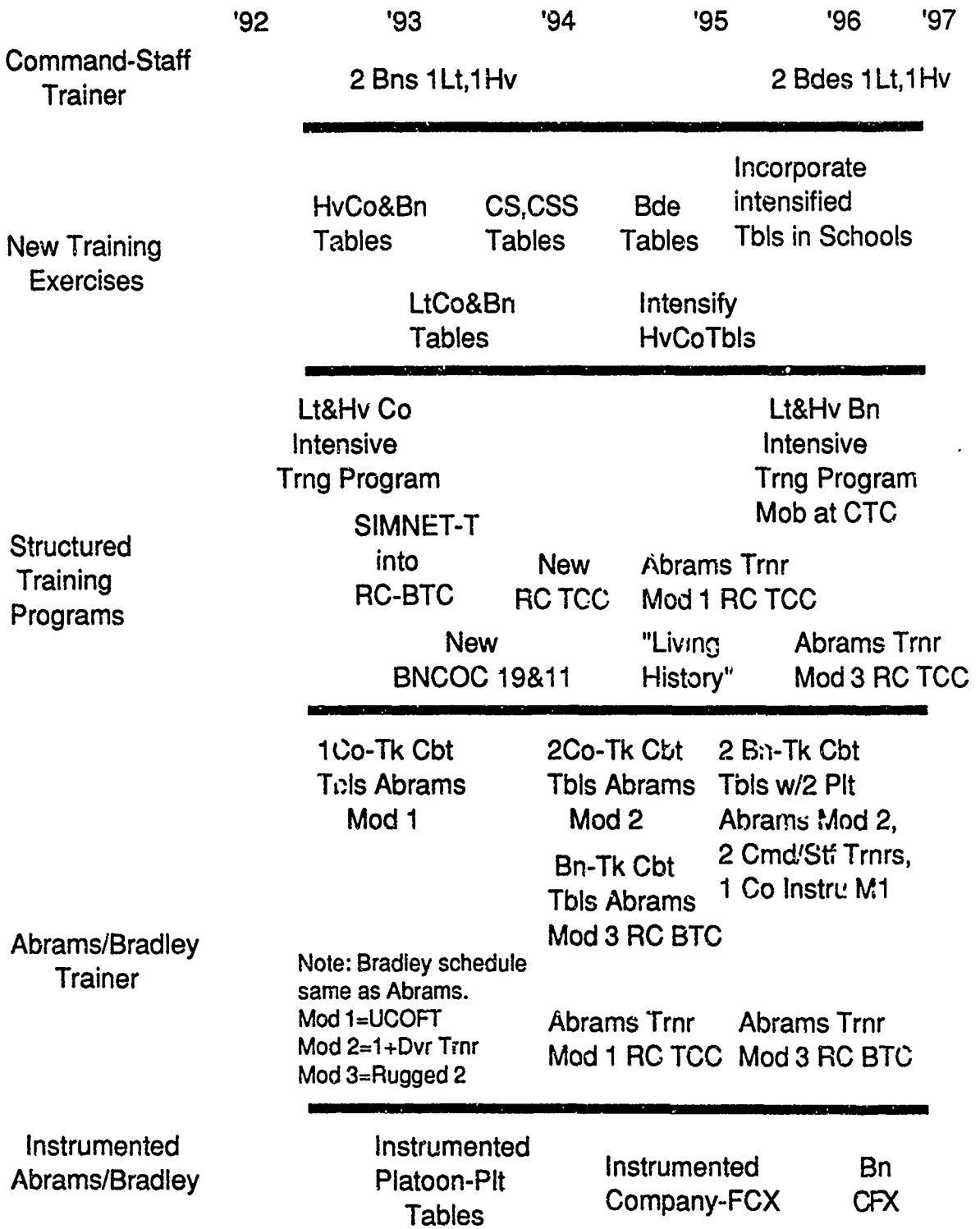


Figure 4. RC Training and Technology Development Schedule of "Trials"-- Proofs of Principle and Training Effectiveness Analyses

VI. TECHNOLOGY IMPERATIVES

In the preceding chapter, six major program areas are defined to focus the development process: Commander-Staff Trainer, New Training Exercises, Structured Training Programs, Distributed Training, Instrumented Abrams/Bradley and Abrams/ Bradley Trainer. These program areas are oriented to specific training readiness requirements of the reserve user and are laid out to encourage paced development organized by the user, synchronized with the user's needs. Now to address the other half of the challenge: integration of this development effort into the overall DARPA Advanced Simulation Program in a manner satisfactory to DARPA. The DARPA program has the following objectives:

Objective and Payoff

- Develop and transition to the Services and industry the technologies, architecture, and infrastructure enabling advanced simulation and modeling technology to make significant contributions to maintaining U.S. military capability while reducing the cost of defense through:
  - -- Early and rapid exploration of technology opportunities and development of rationalized requirements for DoD systems and technologies.
  - -- High fidelity, quick turn-around Computational Prototyping of alternative systems.
  - -- Low risk development programs enabled by traceable cost, performance, and supportability decisions and responsive design and manufacturing methods validated in advance by simulation.
  - -- Direct application of simulation technologies to readiness and warfighting.
- Integrate Simulation into the overall DARPA Program of research, technology development and military applications.

DARPA-ASTO Briefing
17 May 1991.

DoD applications of simulation are quite broad (Fig. 5).

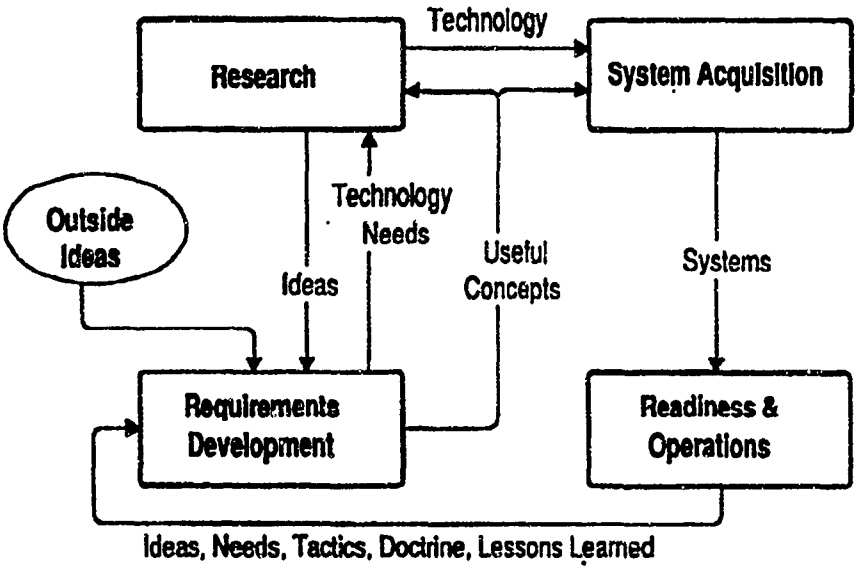


Figure 5. DoD Applications of Simulation

Our interest is centered in the lower half of the model. Reserve forces operational requirements generate the needs which stimulate research. Recommended National Guard needs are summarized in the six action programs of Chapter V. These needs must be translated into DARPA Requirements Development Tasks for DARPA management without losing the overarching user requirement. And there are numerous DARPA Requirement Development Tasks (see Fig. 6).

The challenge is to match these tasks and the broad array of technological opportunities they represent with the Guards' operational needs in a development and evaluation program. The program must tie the DARPA Program Managers and their contractual support to the practical needs of the soldier-user so there is timely field feedback. To accomplish this, five major integrating technology teams are proposed which would focus on development and use of:

- A new generation of simulation/simulators
- Instrumentation of operational quipment
- Expanded behavior representation
- Soldier networking
- Quick response graphics.

Each of these teams would consist of combinations of DARPA/NGB program management; Guard leaders, small unit commanders and staff; scientists; and TRADOC proponents. They would be chartered to ensure selection of most promising research

approaches, timely scrubbing of early prototypes by early Proofs of Principle or Training Effectiveness Analyses, which require merging of training and technology development in unit trials with actual users.

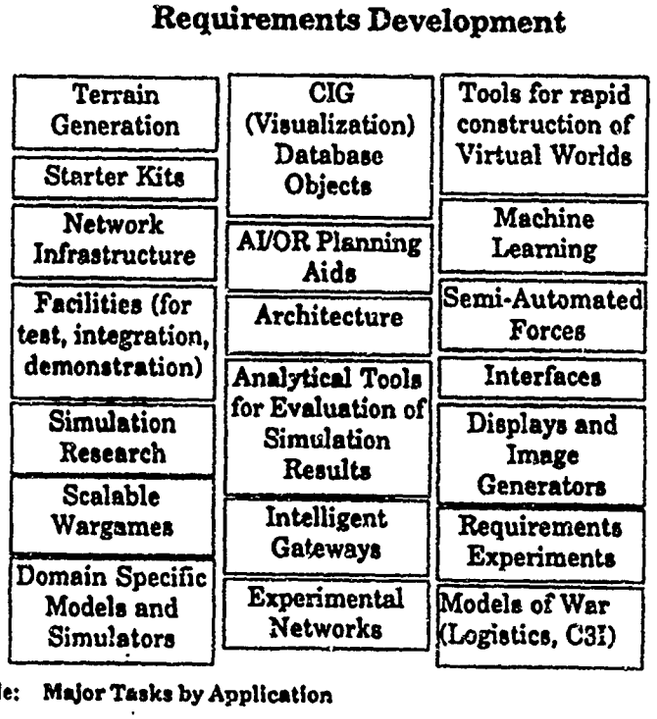


Figure 6. Requirements Development

Broad guidance for the proposed technology teams follows. Each summarizes the various proposals dealing with each of the team areas collated from the overall study. They include reference to the proposed Guard program areas including general objectives for development as well as relevant DARPA Requirement Development tasks. Then the conceptual guidelines appropriate to that program are listed as are the tentative milestones proposed for Proofs of Principle or Training Effectiveness Analyses. In addition to the conceptual guidance, there are several detailed examples of the objective training strategy, if all development is successful. These are intended to provide a visible "mark on the wall" of what is proposed. The best single example is a description of a typical IDT MUTA 4, pp. C-13 to C-15. Other useful examples are provided of small unit training on p. III-13 and III-14 and leader training on pp. IV-17 and IV-18, IV-20 and IV-21, B-5, and C-9. Representative desired AAR Measures of Effectiveness on p. B-8.

A. TECHNOLOGY TEAM: NEW GENERATION OF SIMULATION/ SIMULATORS

1. Relevant Guard Program Areas

a. Abrams/Bradley Trainers (p. V-6, V-7)

Objective: Cabinet would train selected part task critical individual crewman tasks at the appropriate skill level with appropriate behavior cues to cause the crew member in training to progress in the appropriate level of proficiency individually or in combination with the other crew members.

Commander-Staff Trainer (p. V-2)

Objective: Use virtual Tactical Engagement Simulation to achieve distributed command and staff task training effectiveness equal to that achieved by application of the same technology in concentrated sites (SIMNET-T at present).

New Training Exercises (p. V-3)

Objective: Tables executed with subsistent and/or virtual simulation in conjunction with ancillary training support material provide equal or better training effectiveness in less time (50 percent reduction) than existing on-terrain training exercises in training to Proficiency Gate: Mission Training Plan Standards on Mission Essential Task List Tasks.

2. Relevant DARPA Requirement Development Tasks

Starter Kits, Facilities, Simulation Research, Scalable Wargames, Domain Specific Models and Simulators, Architecture, Analytical Tools for Evaluation of Simulation Results, Tools for rapid construction of Virtual Worlds, Semi-automated Forces, Requirements Experiments, Models of War.

3. Conceptual Guidance

Description of distribution, p. II-22.

Required levels of resolution for training, p. II-25.

Complementarity of portals, pp. II-27, III-5.

Design requirements, hybrid compatibility, p. III-11.

Flexibility characteristics, p. III-12, III-13.

Capabilities required, pp. IV-21, IV-22.

AAR data requirements, p. A-9.

Battle commander/staff training, B-11 to B-14.

4. Milestones

- Platoon Combat Tables FORSCOM Bold Shift AT 92 Evaluations FY 92-93
- Heavy Company and Battalion Tactical Tables FY 92-93, Combat Support, Service Support FY 94, Brigade Tables FY 94-95.
- Combat Gunnery Abrams and Bradley with COFT like Matrix. AFV Cmdr/Gunner FY 94 , Driver FY 95, in field FY 95.

5. Trials

See draft schedule, p. V-11. Dependent on the nature of the technology being developed, the "trials" may be Proofs of Principle for technology development or Training Effectiveness Analyses for training development.

B. TECHNOLOGY TEAM: INSTRUMENTATION OF OPERATIONAL EQUIPMENT

1. Relevant Guard Program Area

a. Instrumented Abrams/Bradley (pp. V-7, V-8)

Objective: Training resolution of the instrumentation to be sufficient to permit execution of selected platoon and company echelon combat tables and STX on the actual equipment interacting with other AFV or units on the ground or in virtual simulation.

2. Relevant DARPA Requirement Development Tasks

Starter Kits, Facilities, Simulation Research, Domain Specific Models and Simulators, CIG (Visualization) Database Objects, Architecture, Analytical Tools for Evaluation of Simulation Results, Intelligent Gateways, Experimental Networks, Tools for rapid construction of Virtual Worlds, Interfaces, Displays and Image Generators

3. Conceptual Guidance

Just enough rather than the best, p. II-22, II-23.

Description of instrumented "battle portal," p. II-27.

Need for complementarity with Abrams/Bradley Trainer, p. III-5, III-6.

Proposed design characteristics, p. III-13.

Application for leader training, p. IV-20, IV-21.

4. Milestones

Actual AFV seen in SIMNET, sees only other actual AFV FY 94.

Actual AFV full interaction with virtual battlefield, sees virtual action (shoot and drive) through actual vision blocs FY 95.

Platoon FY 94, Company FY 95. Bradley one year behind Abrams.

NOTE: Other DARPA work will be ongoing to adapt networked weapons such as High Altitude Air Defense to the virtual and constructive simulation battlefields.

5. Trials

See draft schedule, p. V-11. Dependent on the nature of the technology being developed, the "trials" may be Proofs of Principle for technology development or Training Effectiveness Analyses for training development.

C. TECHNOLOGY TEAM: EXPANDED BEHAVIOR REPRESENTATION

1. Relevant Guard Program Areas

a. New Training Exercises (p. V-3)

Objective: Tables executed with subsistent and/or virtual simulation in conjunction with ancillary training support material provide equal or better training effectiveness in less time (50 percent reduction) than existing on-terrain training exercises in training to Proficiency Gate: Mission Training Plan Standards on Mission Essential Task List Tasks.

b. Structured Training Programs (p. V-4)

Objective: 50 percent expansion of content for current institutional courses or unit training programs in existing time and 25 to 50 percent reduction in time required to train to objective task proficiency.

2. Relevant DARPA Requirement Development Tasks

Simulation Research, Scalable Wargames, CIG (Visualization) Database Objects, Architecture, Analytical Tools for Evaluation of Simulation Results, Semi-automated Forces, Interfaces, Displays and Image Generators, Requirements Experiments, Models of War.

3. Conceptual Guidance

Flexibility required by echelon, p. II-24.

Vertical and horizontal complementarity, p. III-6.

Supportive of local "what ifs," p. IV-11.

Characteristics to support drills and tables, p. IV-12.

Flexibility of resolution for individuals, p. IV-17, IV-18.

Quick response for BOS focus, p. A-9.

Representative Measures of Effectiveness to be represented, p. B-8.

Behavior required in battle command/staff training, pp. B-11 to B-14.

4. Milestones

- Heavy Company and Battalion Tactical Tables FY 92-93, Combat Support, Service Support FY 94, Brigade Tables FY 94-95.
- Light Company and Battalion Tactical Tables FY 93.
- New RC TCC and BNCOC 19 and 11 FY 94.
- Multi Battalion Mobilization Exercise FY 96.

5. Trials

See draft schedule, p. V-11. Dependent on the nature of the technology being developed, the "trials" may be Proofs of Principle for technology development or Training Effectiveness Analyses for training development.

D. TECHNOLOGY TEAM: SOLDIER NETWORKING

1. Relevant Guard Program Areas

a. Distributed Training (p. V-5)

Objective: Distribute networked virtual or constructive Tactical Engagement Simulation supporting Abrams/Bradley Trainers, Instrumented Abrams/Bradley or Command-Staff Trainers to the Armory or home as appropriate at costs comparable to home cable distribution in 1991.

2. Relevant DARPA Requirement Development Tasks

Network Infrastructure, Facilities, Simulation Research, Architecture, Analytical Tools for Evaluation of Simulation Results, Intelligent Gateways, Experimental Networks, Interfaces, Requirements Experiments.

3. Conceptual Guidance

Objectives of distribution, p. II-4.

Cost objectives, p. II-22.

Flexibility of locale, p. II-23.

Focus on armory, home use, p. III-10.

Alternative applications, p. III-13.

Leader training distribution requirements, pp. IV-14 to IV-17.

4. Milestones

- Network new SIMNET T and Mobile Trainers FY 93.
- Support intensive Heavy then Light Battalion Training Program FY 93.

- Distribute to Commander-Staff Trainer and Instrumented Abrams/Bradley FY 94.

5. Trials

See draft schedule, p. V-11. Dependent on the nature of the technology being developed, the "trials" may be Proofs of Principle for technology development or Training Effectiveness Analyses for training development.

E. TECHNOLOGY TEAM: QUICK RESPONSE GRAPHICS

1. Relevant Guard Program Areas

a. Abrams/Bradley Trainers (p. V-6, V-7)

Objective: cabinet would train selected part task critical individual crewman tasks at the appropriate skill level with appropriate behavior cues to cause the crew member in training to progress in the appropriate level of proficiency individually or in combination with the other crew members.

b. Instrumented Abrams/Bradley (pp. V-7, V-8)

Objective: training resolution of the instrumentation to be sufficient to permit execution of selected platoon and company echelon combat tables and STX on the actual equipment interacting with other AFV or units on the ground or in virtual simulation.

c. Commander-Staff Trainer (p. V-2)

Objective: use virtual Tactical Engagement Simulation to achieve distributed leader task training effectiveness equal to that achieved by application of the same technology in concentrated sites (SIMNET-T at present).

2. Relevant DARPA Requirement Development Tasks

Terrain Generation, Facilities, Simulation Research, CIG (Visualization) Database, Architecture, Analytical Tools for Evaluation of Simulation Results, Tools for rapid construction of Virtual Worlds, Interfaces, Display and Image Generators, Requirements Experiments.

3. Conceptual Guidance

Detail of resolution, p. II-4.

Responsiveness of terrain generation, p. II-26.

Part task resolution requirements, development considerations, p. III-13, III-14.

Common terrain requirements, pp. IV-15 to IV-19.

4. Milestones

- Heavy Company and Battalion Tactical Tables FY 92-93, Combat Support, Service Support FY 94, Brigade Tables FY 94-95.
- Light Company and Battalion Tactical Tables FY 93.
- Support Command-Staff Trainer FY 94.
- Support RC TCC and BNCOC 19 and 11 FY 94.
- Multi Battalion Mobilization Exercise FY 96.

5. Trials

See draft schedule, p. V-11. Dependent on the nature of the technology being developed, the "trials" may be Proofs of Principle for technology development or Training Effectiveness Analyses for training development.

Technology Teaming is "a way" to organize to focus the sizable development effort over time. Other approaches may be more appropriate. The challenge, however, is to ensure that a large diffuse training development effort extending across small unit and leader training in both unit and institution is kept in effective communication with an equally diverse research effort effort in DARPA--both pursuing a new, presently non-existent, simulation-based training readiness strategy for the Reserve Component. Close continuing coordination is particularly necessary when some of the effort is high risk, therefore very subject to misdirection if the ultimate user is not represented fully in the development process to direct midcourse correction when development does not proceed as well as planned. Alternatively, close and continuing coordination is necessary to exploit the unexpected breakthrough which DARPA may achieve. In addition, frequent Proofs of Principle and Training Effectiveness Analyses which deliberately cut across jurisdictional lines will be required. All in all, a complex management challenge.

VII. DISCUSSION

This is a complex effort. In Defining the Requirement, I indicated that there were four major implied tasks. They are:

a. Make a major difference, improvements at the margin are insufficient. Novel, innovative approaches are mandated.

b. Establish an objective intensive training strategy which will enable a., above.

c. Develop the necessary training support including new technology and appropriate "Guard-friendly" applications.

d. Propose an appropriate training management structure to execute the recommended strategy, both organization and evaluation.

As the proposed program has been described in the preceeding chapters, there are some less obvious yet important assumptions, qualifications, or overarching insights involving the implied tasks that may have become lost in the detail. This chapter is intended to highlight these areas. First, the assumptions:

A. ASSUMPTIONS

The issue of reserve readiness stimulates broad and generally perceptive discussion about the roles of reserve forces--the citizen soldiers--in the national security posture of the United States. The Total Force, its missions, composition, strengths, and vulnerabilities are suitable subjects for debate, particularly as the force mix between active and reserve forces appears a zero sum contest in a period of national defense drawdown. I simply do not consider that debate in this effort. I assume that some combat Guard units will be required in the national defense and that they will be required to gain and sustain some prescribed level of training readiness in peacetime growing, to another pre-combat level gained through post-mobilization training. This is not the study to debate the merits or size of reserves; the issue is to how to make them significantly more ready.

The Reserve Forces training readiness challenge is broad. It extends across the military services. Within the Army, it applies to individual and collective training in both unit and training institution. Further, it manifests itself in different ways in combat

(Infantry, Armor) combat support (Artillery or Engineer) or combat service support (Ordnance or Transportation) units. This study assumes that the most difficult of all training challenges exist in Army combat arms, and that within the combat arms, close combat heavy forces--the Armor and Mechanized Infantry--is a more productive area for analysis than light forces. Therefore, that is the application selected. By inference, if combat forces can be stimulated to order of magnitude change, so can the other less complex areas. This assumption appears to have been validated in Desert Shield as the reasons for the nondeployment of the National Guard Roundout Brigades became an issue of intense national debate, really the only one relating to reserve readiness across the Services.[1]

This effort assumes that a number of innovative training concepts individually validated with both active and reserve component units over fifteen years can be combined to achieve a whole which is significantly better than the individual efforts. There is a potential for synergistic combination if the proper technologies can be developed to permit routine distribution of these innovative training practices to the individual unit for virtually all IDT periods. This appears a reasonable assumption; similar training techniques and exercises are being adopted now for both active and reserve unit training.

The strategy assumes a willing training audience. Units must want to train much more intensively. The officers are eager to master the tables so they can lead their unit by example. Noncommissioned officers are prepared to attend training to proficiency on their equipment and accept competence-basing as the criterion for success. This is a critical assumption. It must be validated in the extensive evaluation effort.

A critical technology development assumption is that successful part task trainers can be developed which are sufficiently inexpensive to permit their proliferation to company armories. The proponent must develop task lists representing new lower cost approaches to training where IDT training proficiency--prescribed by drill or table--is complemented at AT to produce required terminal proficiency by the end of AT. Then simulation and distribution technologies must mature so that many, many more "just enough" training devices are available in local armories. A formidable assumption. That is why the talents of DARPA must be engaged.

---

1 For a thoughtful discussion of roundout issues, see Robert L. Goldich, *The Army's Roundout Concept After the Persian Gulf War*, CRS Report For Congress 91-763F, Congressional Research Service, Washington, DC, October 22, 1991, pp. 53.

B. QUALIFICATIONS

This is an ambitious effort which attempts to lay out an integrated "whole" addressing a broad range of responsibilities for all of the various participants. But it is a bit like building a "duck from feathers." Conceptually the goal is known, bringing it to reality in a world of individuals of greatly varying talents, and motivation is another matter entirely. Heavy reliance is placed on the emerging confluence of telecommunications, education, and entertainment industries, all interacting to ensure resolution of tough technical problems with low-cost solutions designed for the household consumer market. But new training development will be matched with new technologies, few of which will mature as predicted. Successes will be matched with uncertainties and failure. The long conceptual perspective must govern developments over the decade; however, repetitive test, fix, test of the individual and integrated parts will be essential. Consistent direction and a major long-term evaluation effort will be critical.

This effort explores leader training, particularly the battle command staff training integral to execution of Airland Battle doctrine. The scope of the study precluded development in sufficient detail to assess the demands of this training on an already busy chain of command. Until this development is completed and evaluated, it will be very difficult to assess the overall impact of the intensified training strategy on the average Battalion-sized unit.

C. INSIGHTS--IMPLIED TASKS

a. Make a major difference, improvements at the margin are insufficient. Novel, innovative approaches are mandated.

This study suggests the needed measures of effectiveness for the development effort as it does for the training strategy itself. It is difficult to describe an "order-of-magnitude" improvement without placing it in the context of day-to-day training in a unit training program. This is the prerogative of the chain of command. FORSCOM and the National Guard chain of command should consider establishing explicit objectives for the intensified training strategy against which to measure progress. One set of pre-mobilization objectives for 1998 could be for the Armor and Mechanized Infantry Company to demonstrate proficiency in Combat Tables: Gunnery Table XII (Platoon) and Tactical Table I (Platoon) in even years; Gunnery Table VIII (AFV) and Tactical Table L (Company) in odd years. Battle Command Staff Table proficiency would be required for Battalion and Brigade Command and staff. Appropriate post-mobilization tables

demonstrating expert level of training proficiency could also be established. Measures of effectiveness or "gates" such as these portray a clear explicit improvement in training readiness as the goal of the effort.

Whatever the explicit MOE selected, it should extend through mobilization into post-mobilization, pre-contingency deployment training. Training Effectiveness Analyses and Proofs of Principle should assess the effectiveness and efficiency of the strategy in both pre- and post-mobilization environments.

FORSCOM and TRADOC are currently engaged in a major effort to improve the training readiness of the Round Out Brigades-Bold Shift. The program relies heavily on structured training including tables and STX to gate proficiency, prioritization of task training, intensified leader training, and use of current training support. It is the innovative near end of the change advocated in this study. The two efforts should be coordinated closely.

b. Establish an objective intensive training strategy which will enable a., above.

Implementation of the conceptual principles discussed in Chapter II are key to enabling the intensive training strategy. The most difficult will probably be establishing the chain of command as the primary trainer rather than the Observer/Controller. The O/C is not only an expensive crutch but also they, by their presence and competence, erode the young soldiers' confidence in his or her chain of command. Weaning the unit off the O/C will require extremely well constructed tables designed so that the average leader with typical professional development and motivation can in fact train with his immediate subordinates to competency before they lead their soldiers in executing the tables.

As suggested above, the proposed exercises and technologies under development need to be introduced into unit training programs as rapidly as possible so that effectiveness can be judged early on.

The focus of the tables sketched out in the study was maneuver with some fire support and command and control. Clearly, combat support and combat service support need to be included initially as they would impact at the company echelon. For example, rearm, refuel, repair tasks need to be incorporated in the programs drawing on the proposed strategy. In addition, there is a clear need to build in field craft tasks. Soldiers should be in the field, on equipment performing pre-combat checks and the like as frequently as possible.

The study deliberately avoids state training requirements. These are clearly important to the State Administration. They appear to vary state by state. The Guard will have to determine what percentage of the annual training effort must be set aside for state training. Then the long term training strategy will have to work around the state requirement. If accommodation does not seem possible, the Total Force leadership needs to intervene to establish priorities as the technologies are being developed.

c. Develop the necessary training support including new technology and appropriate "Guard-friendly" applications.

Technologies will mature continuously. How much is enough becomes a pressing issue. There is obviously no approved solution. If possible the program should be laid out so that there are steadily improving surrogates available for TEA. A good example of this is the Mod program for the proposed Instrumented Abrams. In this case, steps in probable development are assumed, then sufficient quantity produced to permit incorporation of the improvements in small unit training. Each step should be the subject of a TEA so the incremental training benefits can be determined. Modular growth potential should be sought wherever possible.

One of the most difficult aspects of technology development will be to develop the device or training support so that it is "good enough" for the requisite part task training then use technology to drive the cost down, *not* to improve the product. The issue is discussed in the principle of improved resolution in Chapter II.

Distribution of training capability to the lowest possible echelon will be a vital ingredient in the program. However, distribution alone is not enough. The applications should also be packaged to support quality control in conduct of the training. Evaluation of Measures of Performance should be easily done by the average leader in the average distributed location. "Automated" AAR involving routinized collection of important MOP then presentation in a manner easily understandable within the company will be critical to distributed quality control. Then, suggested remedial training to standard should be proposed to the chain of command in a non-intimidating way.

d. Propose an appropriate training management structure to execute the recommended strategy, both organization and evaluation.

The management structure proposed is elaborate, appropriate to the complexity of the effort. It is not to tell DARPA or the Guard "how to." Rather, it is to indicate the kinds

of coordination which will be required. There is a sizable "green suit" coordination problem. The Guard units and commands, the FORSCOM as the responsible deploying command, the proponents of TRADOC developing the various training strategies--all need to be in sync. It seems almost as difficult on the DARPA side considering the wide array of technologies and various governmental, private industry, and university players in technology development. Then these two groups need to be brought together both for normal coordination and to reground the effort in the realities of life in the average company-sized unit tens if not hundreds of miles from its higher headquarters. This is a very different environment than most of the support personnel are accustomed to. And, of course, very frequent Proofs of Principle and Training Effectiveness Analyses are essential to keep bringing all "back to reality."

TEAs are very expensive in dollars, manpower, and time. Sample sizes must be large enough to provide credible results with appropriate control. Too often, Tactical Engagement Simulation has been subject to anecdotal effectiveness assessments which leave all confused. That simply should not continue. There are genuine questions concerning training applications in distributed units. Traditional intuitive judgments may not apply; they should not be trusted in a program involving so many changes to the experiential wisdom.

Serious consideration needs to be given to continuity of personnel in this effort. Integrated progress probably will not be evident for five years or more. Considerable expertise will be required to guide the program. The development team should be organized if possible for a five- to eight-year management period. Furthermore, as discussed in the Enclosure on Evaluation, some organization such as ARI should be given long term evaluation responsibilities.

The TRADOC Proponent is a particularly critical player in the development team. The proponent is uniquely vested with overarching responsibility to apply the concept-based requirements system across proponency units--CG The Armor Center for Armor and Cavalry units. In some cases the training readiness challenge may not be solely training driven. Organizational changes may be the best way to correct a serious training problem. The proponents need to be involved across the full range of their responsibilities to ensure that training solutions are sought for training problems.

D. SUMMARY

Some may find it unsettling that this effort proposes to influence significantly both efficiency and effectiveness of the training process at the same time or that the effort presumes to create order of magnitude change. Order-of-magnitude change is rare, seldom produced in or by bureaucracies, which generally produce the lowest common denominator of institutional compromise. Normally, order-of-magnitude change is associated with weapons--innovative technology such as gunpowder, the atom bomb, or perhaps stealth. That is to a certain extent true here, for a major premise of the proposal is the extended application of the most current new "weapon"--the processor--to reserve training. But there is a second element undergirding the expectation of order-of-magnitude change. For good and bad reasons, current reserve training strategy, policy, and program is inadequate. It simply does not reflect sensible, timely application of the active Army's training revolution to the reserve environment today. Until the very recent past, the fundamental differences in the reserve environment were not incorporated in the concept-based requirement system. When the significant impacts of focused application of current training capabilities are multiplied by the potential of proposed future DARPA/NG innovative training and technology development, order-of-magnitude change is a realistic expectation. Improvements in both effectiveness and efficiency are not only possible, partly because the status quo is so poor, but also essential to meet the promise of order-of-magnitude change. Provided consistent competent direction, funding, and patience to conduct the necessary evaluations, achievement of an unprecedented beneficial improvement in reserve forces training readiness is low risk.

VIII. CONCLUSIONS AND RECOMMENDATIONS

The objective of this study is to develop and design a new simulation-based intensified training readiness strategy for the Reserve Component intended to create an order-of-magnitude improvement in the effectiveness and efficiency of Reserve Forces training. Measures of success were postulated to be the ability to compress one week of pre-mobilization summer training into one weekend or 60 days of post-mobilization training into 15 to 30 days both by 1998.

A progressive program has been developed to address the twin challenges of developing new training and new technology applications within the policy direction of FM 25-100, FM 25-101, the Combined Arms Training Strategy and the Guard's Integrated Training Strategy. The program parts are:

- Identification and focusing of four areas of significant potential leverage in effecting change;
- Establishment of conceptual directions for design and development of both training and technology;
- Several development programs for Guard leadership; and
- Suggested management techniques to blend soldier need and scientific research. These techniques include both organizational teams and an intensive evaluation effort to bring emerging developments before average citizen soldiers in distributed armories.

A. CONCLUSIONS

1. There are four areas of significant leverage:

- **Compression** of the time required to train to proficiency is a challenge of training development by the Guard teamed with the TRADOC branch proponent. Existing training exercises are excellent but they need to be supplemented by the establishment of new more intense exercises merged into structured training programs.
- **Distribution** of training should permit the shift of most training to the local unit if not to the home of the citizen soldier with full netting throughout the chain of command.

- **Modernization** of training support should permit much more effective training support highly flexible to varying requirements of the small unit commander and leader. Both distribution and modernization involve development of new high risk technologies. Finally,
- **Prioritization** of training requirements is necessary to focus the training on a reduced number of high priority individual and collective tasks. All need to be addressed to achieve the breakthrough sought. These leverage areas are described in Chapter II.

2. The next step is identification of the conceptual direction required to guide detailed development of both training and technology in support of the leverage areas above. Fifteen decision rules are proposed. Each is explained in Chapter II.

a. Compression

- Immersion in warfighting
- Train in unit context with complementarity of training on actual equipment and in simulation
- Shift the loci of training
- Train the unit to train (decentralized) while training its leaders (centralized) in the school
- Encourage local "what ifs"
- Chain of command not Observer/Controller training
- Use Drills and Tables to train basics
- Design training to encourage competition
- Encourage supportive unit policies.

b. Distribution

- Distribute training to the lowest feasible echelon
- Incorporate low cost consumer electronics.

c. Modernization

- Develop flexibility of echelon, locale, means, and application
- Improve the resolution of virtual realities
- Provide improved networked simulators (freestanding and appended to actual equipment)
- Create new training exercises.

d. Prioritization

- Train "levering" battle tasks
- Institutional training priority for leader training.

Chapters III and IV expand this guidance for use by training and technology developers by relating the general concept to small unit and leader training in institution and unit in turn. This guidance should be sufficiently explicit to direct the initial development effort but it will not suffice to get a tangible product out for soldier and leader assessment.

3. It is essential to create early opportunities and focus for practical use and evaluation of these conceptual "good ideas." To that end, specific projects are necessary as development efforts for the Guard. Six are proposed in Chapter V:

- Commander-Staff Trainer
- New Training Exercises
- Structured Training Programs
- Distributed Training
- Abrams/Bradley Trainers
- Instrumented Abrams/Bradley.

Representing a combination of training development (New Training Exercises and Structured Training Programs) and hardware training support, these projects should by their nature both force and encourage frequent field trials with citizen soldiers to ensure that the necessary intensification of training is in fact taking place. These projects need to be directed by the Guard both in detailed design and in repetitive evaluation to ensure that the product trains as desired on a distributed basis.

4. Finally, the challenge is to create a management structure which will ensure that the white smock of the scientist meets the battle dress of the citizen soldier to the benefit of both--a product that creates new technology applications to the training readiness benefit of soldiers. This is a Technology Teaming problem to be met by joint workgroups led by both DARPA and the National Guard. To this end, several pacing challenges are proposed for priority work under the guidance of development teams composed of DARPA/NGB program management, Guard leaders, small unit commanders and staff, scientists and proponents. Several critical development areas are proposed in Chapter VI:

- A new generation of simulation/simulators
- Instrumentation of operational equipment

- Expanded behavior representation
- Soldier networking
- Quick response graphics.

These development areas need to be stressed by an extensive evaluation program consisting of frequent Proofs of Principle and Training Effectiveness Analyses during the period FY 93-97. Planning in these areas should begin as soon as possible and several pacing trials could start within months in association with the various intensified training efforts under way in execution of FORSCOM Bold Shift and probable follow on efforts. A tentative listing of trials is included on p. V-11.

5. The development model should be successful for Guard combat units despite known uncertainties of high-risk development--the traditional DARPA challenge. Combat service and combat service support training development should follow, as should translation to U.S. Navy and U.S. Air Force. This should be less challenging, though, as most of the new development will have been done and proofed with the Guard. Other challenges are discussed in Chapter VII.

B. RECOMMENDATIONS

National Guard and DARPA

1. Approve the model and conceptual direction above for execution as the simulation-based intensified training readiness strategy.

2. Develop a DARPA/NG action program to implement the training readiness strategy.

3. Establish development teams to complete the detailed planning required for the initial programs proposed in Chapter V. Initiate selected start-up actions in association with FORSCOM Bold Shift.

4. Initiate a separate effort to complete development of battle/command staff training to Battalion and Brigade levels and to develop training support required for combat support and combat service support training. This development should be compatible with light forces, Special Operating Force, and U.S. Marine Corps use.

ENCLOSURE A

TACTICAL TABLES

ENCLOSURE A
TACTICAL TABLES

Combat Tables have now been used to train Abrams and Bradley crews and small units for several years.

> Tank gunnery tables train armor units to hit the target; tank tactical tables use gunnery proficiency and MILES to train armor units to respond rapidly to OPFOR activity so targets can be destroyed.
>
> FM 17-12-1

The Tables consist of Gunnery Tables and Tactical Tables. Gunnery tables essentially reflect analysis of the most critical tank direct fire combat tasks, such as single and multiple targets of varying danger presented sequentially or simultaneously in various visibility conditions. The AFV is fully operational or has certain capabilities degraded. The various tasks to be trained are presented as mini-combat action vignettes--a series of very specifically defined snapshots where Mission, Enemy, Troops, Terrain, and Time Available (METT-T) have been effectively frozen to create a very precise situation where performance (hits in prescribed time) results in qualification or non-qualification. Gunnery Tables I (Individual AFV) through XII (AFV Platoon) have been developed for training and precise evaluation. There is no question in the soldier's mind as to what level of individual or crew performance is expected to qualify. For detailed description of Abrams Combat Tables, Gunnery and Tactical, see FM 17-12-1 dated 1984.

The tasks trained and evaluated in the gunnery tables are limited to those live fire tasks which can be conducted safely within available resources. Approximately 16 of 64 possible task combinations can be trained. Numerous important tasks involving fire and movement and AFV section or platoon maneuver with fire support cannot be trained live fire. To ensure that these tasks are trained, tactical tables were developed--an increasingly difficult series of combat action vignettes grouped into Tactical Tables A (Individual AFV) to I (AFV Platoon). These vignettes are as rigorously defined as the gunnery tables. That is, specified targets at specified ranges on specified azimuths from the AFVs. The exercises are designed to be fought in subsistent Tactical Engagement Simulation (MILES)

or virtual Tactical Engagement Simulation (SIMNET-CCTT) where the opposing force can fire back. Since live fire safety constraints are not in effect, there can be 360 degree interaction with aviation, artillery, and dismounted infantry. It is a rich training situation designed to be "fought" interspersed with the gunnery tables to ensure full live fire and maneuver proficiency is trained and sustained. These tactical tables are now in use.

Viewed from a doctrinal training perspective, the tactical tables are a form of lane training described in FM 25-101 as

> . . . a technique for training primarily company team and smaller units on a series of selected soldier, leader and collective tasks using specific terrain . . . multiechelon techniques to maximize the efficient use of limited terrain and control conditions for formal or informal evaluations . . . externally supported, resourced, and evaluated . . . resource intensive . . . narrow the focus and select only the most critical METL or collective tasks for training.
>
> (p. 4-8).

Lane training was employed by active units including the National Training Center in the Desert Shield train-up of the roundout brigades. In this case, the lanes trained Situational Training Exercises. Situational Training Exercises (STX) lanes are described in FM 25-101 as

> . . . mission-related, limited exercises . . . teach the standard, preferred method for carrying out the task . . . may be modified based on the unit METL, or expanded to meet special mission requirements. To ensure standardization, service schools develop STXs to teach the doctrinally preferred way to perform specific missions or tasks.
>
> (p. C-7).

STX are absolutely applicable for lane training; they permit a focused intensive approach to training to contingency METL--precisely what was done at the NTC with the focus on deliberate breach missions, a known challenge in Desert Shield. But although clearly superior for TOE unit mission training, the STX may not be the most effective, efficient training approach to institutional and reserve training. Both institution and reserve unit have similar challenges:

- Very limited time availability for training
- Training individuals of greatly varying competence
- Need to train to general battle focus (train the contingency METL after mobilization)
- Need to educate values--responsibility, accountability--as well as train tasks.

Institutional training focuses on intense performance-oriented training to standard in set piece military operations fought and analyzed to stimulate training. That is precisely what we discussed above with respect to the tactical table component of the combat tables. Are training techniques similar to those established for the tactical tables now trained in institution and unit more broadly applicable for the reserves? To intensify reserve training, we seek to compress training by:

- Creating immersion environments where exciting, challenging potentially competitive training occurs in a unit context.
- Merging fire and movement into one exercise.
- Establishing the rigor of training and evaluation to standard.
- Limiting training to the critical warfighting tasks.
- Enabling quality distributed training on-equipment or in simulation.

All of these objectives appear attainable by application of lane training to exercises--vignettes with predetermined METT-T to ensure uniformity of institutional and reserve training experience. Essentially employing expanded tactical tables to prepare for and reinforce not replace rigorous subsistent or virtual Tactical Engagement Simulation employed in STX-training to standard.

Tactical tables are limited exercises to train a standard, preferred method for fighting selected ARTEP MTP. METT-T is fixed to permit repetitive training and evaluation of specific unit or battle staff missions or tasks to standard in an effective, efficient "package" for uniform national application in distributed simulation.

TANK TACTICAL TABLES EXISTING

Individual Tank
A Individual Crew Member tasks
B Crew Drills
C Crew Reaction Exercises

Tank Section
D Coordination Between Crews
E Section Drills
F Section Reaction Exercises

Tank Platoon
G Coordination Within Platoon
H Platoon Drills
I Platoon Reaction Exercises

COMBINED ARMS TACTICAL TABLES

ADDED

Tank Heavy Company Team
J Coordination Within Company Team
K Company Team Tactical Actions
L Company Team Reaction Exercises

Battalion Task Force(2 Tank,2 Mech)
M Coordination Within Bn TF
N Battalion TF Tactical Actions
O Battalion TF Reaction Exercises

The Concept-Tactical Tables

Tactical tables are a new tool in the commander's training bag--a way to train to base proficiency in small unit collective tasks for institutional and RC unit training where contingency battle focus has not been established and there is a clear need for more time-efficient, effective training. Creation of something genuinely new is challenging. The challenge for the training developer seeking immersion training is to test, fix, test with Training Effectiveness Analyses as all get smarter on how to best do this.

Tactical tables are intended to create a very intensive training exercise for small unit, leader, and battle/staff training to achieve floor proficiency. Not a marginal change--rather a really new way of training to compress one week of AT for the RC into a weekend IDT or triple the tactical experiences/training provided in the "schoolhouse" with constant or reduced time. Note the immediate objective is not "battle ready" since the training is not to contingency METT-T. Also, since the training is to be conducted in the average RC combat unit, the training should be designed not only to achieve the training objective but also to support the most effective, time-efficient training that is possible--per the objectives above. In responding to the often unique requirements of the RC, we will have to develop both new training technology and new distributed applications. In scoping down the immediate expectations to that which can be done "today," we realize that the "mark is on the wall" for the future--and move to that future as rapidly as possible.

"Tables" can be thought of conceptually as a collection of golf "holes" each with specified length, green, traps, and an established par. These "holes" can be duplicated precisely in each small group leader class or in hundreds of local armories through distributed simulation. A training "golf course" can be made up of any number of prescribed "holes" dependent on the training requirements of the various institutional courses or using RC units. The essence of training is execution of the appropriate "holes" with appropriate AARs to par in order to achieve floor proficiency. Again, not established for now is "how many holes constitute a course"--for OBC, OAC, or the base program for an RC tank-infantry team? That follows with the development of proposed unit training programs and considerable test and evaluation.

The "holes" could be "played" two alternative ways for solid training benefit. To continue the golf analogy, assume that proficiency equates to par on all 27 holes of the course. Assume the existence of three levels of tables--Coordination Tables, more difficult Tactical Actions Tables, and tough Unit Reaction Exercise Tables, suggesting that one would execute the most important ARTEP-MTP missions at the easiest level, then progress to the higher levels in turn. A training program could consist of nine "holes" involving

important missions like Movement To Contact, Hasty Attack, Hasty Defense at Coordination level, then nine similar missions at Tactical Action level, then nine of the same missions at Unit Reaction level. The entire "course" would consist of 27 different "holes" or vignettes.

An alternative could be nine basic "holes" at the coordination level, each of which is made more difficult (tougher enemy, etc.) to become the nine Tactical Action Tables, then additional difficulty added to the basic nine to create the Unit Reaction "holes." In this case there would be three variants to only nine basic "holes" or vignettes.

Coordination Tables

- Review common understanding of basic Tactics/Techniques and Procedures
- Full unit-all AFV manned, no degrade to capability
- Minimum OPFOR (SAFOR) to stimulate unit action
- Crawl, walk, run to standard--more difficult conditions

Tactical Actions Tables

- Train priority combined arms collateral operations
- Full unit--all AFV manned(K), no degrade to capability
- Competent, aggressive OPFOR "fighting to win"
- Stress all BOS, embedded AAR

Unit Reaction Tables

- Intense,demanding tactical situations requiring quick response
- Degraded mode-key personnel casualties, logistic shortages, OPFOR(SAFOR) advantage, challenging missions
- Stress combined arms and joint(USAF-CAS) coordination

For a representation of how the various vignettes might look like at the levels of difficulty, see Table 1, Tactical Tables--Company Team (Heavy) and Table 2, Tactical Tables--Battalion TF (Heavy).

The first alternative--27 different vignettes which must be fought to par for base proficiency--is the most complete but also the most difficult to develop. More paperwork

to create, but easy to represent in simulation. These twenty-seven different METT-T vignettes would be uniform from one replication to another. This should result in not only quicker, better training, but also more of a challenge to the energies and psyche of units, therefore generating greater immersion, more interest, and better learning. However, both approaches should be assessed.

Appropriate training development design characteristics are:

- Each "hole" is a tactical vignette. The distributed simulation is initialized at a precise METT-T. A unit with a prescribed mission has been frozen in time at a point in execution of the mission. After the fight starts (time is unfrozen) new events (enemy action, etc.) occur in accordance with a published prescribed OPSCHED. No surprises, the unit is expected to fight and refight the "hole" until it can demonstrate capability to achieve "par." NOTE: This is not battle-focused STX training to variable METT-T; it is repetitive training to floor proficiency incorporated as one element of extremely intensive training on actual equipment, simulator, and simulation.

  Development Requirement: Detailed initialization guidance, OPSCHED of subsequent events for each vignette. Subsequent events described very precisely. Ex: at H hour (unfreezing of action) plus 12 min 35 seconds an MRC in column formation appears over the hill at 12345678 moving at 15 mph on an azimuth of 1800. Par specifically defined as a loss exchange ratio,or enemy losses while friendly unit remains green or .... For schooling purposes, the success conditions should be more explicit than in MTP for Battle Focus mission training.

- The unit in training is provided an OPORD as well as a summary of key events which preceded the instant of initialization--so that the unit in training has a battle context.

  Development Requirement: OPORD and key events leading to initialization (H Hour). This is essential particularly for the more challenging Reaction Tables where the unit is placed in difficult situations--the kind not normally present in training. The unit cannot be permitted to speculate how the situation became so bad, the issue is how to get out of it. At the same time, the chain of command being trained needs to be "brought along" in execution of normal TLP to the point that they are coopted to the table situation (explicit METT-T) with professional interest and enthusiasm.

- The RC using unit should be provided a short intense unit leadership train-up program for the chain of command to use to develop the necessary tactical competence and confidence to conduct the training to standard prior to the UTA with their soldiers. The training material should include detail on the tactical

table to be trained, training tips for discussion with soldiers, alerts to usual short falls in execution, and recommended actions to correct probable deficiencies.

Development Requirement: Training package as described for each tactical table.

- Each vignette should include a prepackaged AAR; that is, execution of the vignette triggers automatic collection of AAR data in preselected Measures of Performance or Measures of Effectiveness which have been announced to the unit well in advance of training--with flexibility provided to the training unit chain of command to add selected MOP of unique command interest. AAR MOE data should be available for chain of command use within 15 min of completion of the vignette assuming entire vignette should be doable in 1/2 to 1 hr to fit in MUTA 1 (4 hr) with multiple repetitions for RC; time as desired for institutional training.[1] The AAR material should be prepared and presented to encourage AAR execution by the leaders of the units in training rather than Instructors or O/Cs. The AAR should itself be packaged for the use of the unit chain of command. It should be formatted for detailed timely highlighting of major training points integral to the type operation being conducted, and to stimulate discussion by participants.

  Development Requirement: With proponent, develop a pre-packaged AAR data collection program and AAR format designed to encourage user AARs.

- Initialization easily and quickly (15 min). In addition, some modification of the METT-T of the base vignette should be possible if the unit desires to fight a rerun with an improved enemy, or additional friendly capability (such as additional Fire Support or Mobility, Countermobility, Survivability, etc.). Rapid AAR and other special features would remain to the MOE established in the base vignette.

  Development Requirement: Technical design to permit the above including Combat Instruction Sets (programming guidance) for additional SAFOR capabilities which might be added.

- There should be a "school solution" capability to fight the vignette (the distributed simulation on "full automatic")--the "perfect par" demonstrated by the proponent including a full AAR. This could be presented after the unit has

---

1 As a general proposition vignettes should be short--a limited number of specific teaching points. The intensity of the training experience will cause the participants to remember what happened. The issue is to bring out the why during the AAR, then permit the unit to do it again and again until "mastery" or "par" is achieved. Longer exercises are, of course, appropriate for training programs, but they should not be Tables with fixed METT-T; rather, they should be STX leading to FTX as described in 25-100, 25-101. In the tables, we are training to a floor designed to be uniform across the force.

completed its training on the vignette so that the unit in training has the opportunity to observe how the vignette should be done (a way to encourage users to propose a "better way" to the proponent to encourage competition). "Par" should be demonstrated by organizations using common SOPs established for instructional purposes by TRADOC.

Development Requirement: Proponent "fight" the vignette to establish the "par." Issue the "approved solution" for local refight. [2]

---

2 Although the tables address small unit collective tasks, there are clearly important individual and leader tasks which must be trained and sustained to ensure collective performance to standard.

Table 1, Encl. A. Tactical Tables--Company Team (Heavy)

Coordination Tables

Company Team Coordination Tasks

- Neutralize a bypassed MRC by direct fire--Abrams and Bradley
- Execute a company-size engagement area employing primarily Artillery--FASCAM and Atk Helicopters
- Conduct hasty breach of a simple obstacle
- Delay on alternating positions supported by priority of fires
- Execute counter recon, Bn Hasty Def.
- Execute Passage of Lines to the rear under pressure

- Tables executed crawl, walk, run increasingly difficult conditions
- Unit provided normal support unless indicated otherwise
- "Automated" collation of AAR info for desired MOE for each task/BOS O/C not required, flexible for command modifications.
- Pre-determined METT-T with specific MOE for AAR training, capability for rapid "refight".

ILLUSTRATIVE EXAMPLES OF TASKS ACTUAL TABLES CONSTRUCTED BY PROPONENT FROM ARTEP-MTP

Tactical Actions Tables

Company Team Tactical Actions Tasks

- Hasty Attack of RAG Battery Position
- Hasty Breach of obstacle covered by effective direct and indirect fire
- Hasty defense against attack by 4-6 Atk Helicopters
- Deliberate Defense--establish then execute Bn size engagement area
- Movement to Contact mission opposed by OPFOR Bn also moving to contact
- Delay an MRR for requisite time
- Conduct Road March under Air Attack

Reaction Tables

Company Team Reaction Tasks

- Hasty defense against unanticipated MRB flanking attack
- Delay against MRR, 60% TOE eqpt, 50% Cl III, V, Div. Priority of Fires
- Movement to Contact/Hasty Atk against unanticipated MRC in improved psns, Tm Cmdr and FIST KIA
- Relieved unit, Relief in Position, attack by MRB 15 min before cmd passage, extensive EW
- Road March, Resupply, Occupy Assembly Area under heavy Fixed Wing/Rotary Wing Attack

- Tactical Actions and Reaction Tables are combat action vignettes-the unit is placed in challenging situations which in some cases require the unit to focus combat power normally reserved for a higher echelons.
- In each of these situations, the Company is fighting as an element of a larger unit but is at the decisive point in the larger operation.

Table 2, Encl. A. Tactical Tables--Battalion TF (Heavy)

Coordination Tables

Battalion TF Coordination Tasks

- Coordinate direct and indirect fires in sector to neutralize OPFOR air defense
- Conduct JAAT into MRR engagement area
- Conduct deliberate attack on MRC
- Conduct hasty breach of a simple obstacle
- Conduct tactical road march (including resupply) under OPFOR indirect fire, fixed wing and rotary wing attack
- Delay on alternating positions. Low risk, Div. priority of fires
- Conduct movement to contact, hasty defense against TR

ILLUSTRATIVE EXAMPLES OF TASKS ACTUAL TABLES CONSTRUCTED BY PROPONENT FROM ARTEP-MTP

Reaction Tables

Battalion TF Reaction Tasks

- Conduct movement to contact,hasty defense against TR supported by Hind Regt(-)
- Delay against MRD, 70% TOE eqpt, 60% CI III&V, DS from 2 Arty Bn, Atk Helicopter Bn, 3 Fits CAS, Cmd Gp KIA
- Extended tactical road march under FW, RW attack, hasty attack of MRC interrupted by hasty defense against TR attack from flank or rear.
- Conduct Deliberate Attack of MRB, Div. priority of support

Tactical Actions Tables

Battalion TF Tactical Actions Tasks

- Conduct Hasty Attack of MRR Cmd Gp/DAG Arty Bn reinforced by 6-8 Hinds
- Conduct Hasty Breach of complex obstacle covered by effective direct and indirect fire
- Conduct Deliberate Attack of MRC in prepared positions
- Conduct Deliberate Defense including an MRR size engagement area with JAAT
- Conduct tactical road march, movement to contact, hasty attack of OPFOR MRD Forward Detachment
- Delay an MRD for requisite time

- Tables executed crawl, walk, run, increasingly difficult conditions
- Unit provided normal support unless indicated otherwise
- "Automated" collation of AAR info for desired MOE for each task/BOS O/C not required, flexible for command modifications.
- Pre-determined METT-T with specific MOE for AAR training.

- Tactical Actions and Reaction Tables are combat action vignettes--the unit is placed in challenging situations which in some cases require the unit to focus combat power normally reserved for higher echelons.
- In each of these situations, the Battalion TF is fighting as a subordinate unit to a Brigade or directly under Division control.

Table 3, Encl. A. Company Team Tactical Tables

The Armor School is preparing tactical tables for potential use in implementing FORSCOM RC training initiatives. The exercises developed are intended to be used with units training at Fort Knox as an RC Regional Training Center as well as potentially the Officer Basic and Officer Advanced Courses. One draft table, prepared Spring, 1991, is extracted below to indicate how the process of training development has begun. Training Effectiveness Analyses should follow.

COMPANY TACTICAL TABLES: LEVEL 3
DEFEND FROM BATTLE POSITION

TASK: Defend from a Battle Position

This exercise is designed to train/evaluate company team performance while defending from a battle position. The basic tasks being evaluated are:

- Prepare for Combat
- Defend
- Employ Indirect Fire in the Defense
- React to Indirect Fire
- Support by fire (overwatch)
- Withdraw under Enemy Pressure
- React to Air Attack

CONDITIONS: See Situation, OPORD 84-1 with overlay

STANDARDS: To be successful the unit must score a 70% or higher in this exercise.

The company team must:

- Destroy enemy MRB(-) in EA CAT using direct and indirect fires.
- Suppress enemy so that TM A is able to displace to BP 13.
- Displace to BP 43 per instructions in OPORD.
- Defend/retain BP 14
- Lose no more than 30% of the company team to enemy direct/indirect fire.
- No fratricide

(continued)

Table 3, Encl. A (continued)

SITUATION

1. You are the commander of Team D, TF 1-10 AR consisting of two tank platoons and one mech platoon. Your unit is at 79% personnel strength, 9 M1A1 tanks and 3 Bradley IFVs. The company team has occupied BP 42 for the past 10 minutes. Your team has been in contact for two hours now and you are at 60% Class 3 and 40% Class 5. You have already lost a tank, D-33, to enemy artillery. One of the Bradleys in the Mech platoon, A-14, had transmission problems and was evacuated to the UMCP late last night. You have no prepared vehicle positions on the BP. Recent rains have made low-lying areas difficult to move through, but these areas are drying rapidly with the strong winds that have developed. The weather is now clear.
2. Your brigade is conducting a defense in sector to destroy an enemy MRD and contain the enemy bridgehead in the Brandenburg area. TF 1-10 AR defends in sector to contain the enemy north of PL Yellow. Two task forces from the 52nd Mech DIV completed their rearward passage of lines through the TF sector before your battle started. TF 1-10 has priority of fires.
3. The time is now --hrs. Your team in BP 42, TM Mech in BP 32, TM A in BP 12, and B Co in BP 23. You have deployed your company team on BP 42 with 1st PLT vic ES 794976, 2nd PLT vic ES 793978 and the Mech PLT vic ES 793982, all oriented into EA CAT. You and your FIST are located with 2nd PLT and the XO with the Mech PLT. The Scouts are now screening to the west. You do not have priority of fires. You have two WIA in the Mech platoon from artillery fire and the MRB is pushing deeper into EA CAT along the highway. The TF commander notified you that the task force may get some attack helicopter support. Enemy artillery fire continues to fall around your position.

LIST OF EVENTS

1. Company team is located in BP 42, in overwatch as TM A displaces from BP 12 to BP 13. MRB continues move into EA CAT along both sides of the highway, with one MRC(+) vic ES 771979.
2. 10 enemy vehicles cross PL STOOL.TM D displaces from BP 42 to BP 43.
3. TM D defends from BP 43. Two AH-64 attack helicopters arrive on station near BP 43, vic ES 807950. TF commander orders the helicopters to assist TM D, and instructs the TM D commander to direct the helicopters in support of the team's defense. The helicopters break station as two SU-25 aircraft attack TM D on BP 43. The enemy aircraft approach from the east and northeast of BP 43. The attack helicopters do not return to assist the company team.
4. TM A is destroyed defending BP 13. Another MRB(+) enters the battle vic ES 759959 oriented on BP 24. The TF commander fires FASCAM in front of the enemy force moving on BP 13 and sends FRAGO to TM D to displace to BP 44. As TM D passes vic ES 825925, TF commander sends FRAGO to TM D to defend from BP 14, oriented on TRP 24 and 22.
5. MRB(+) continues its attack oriented on BP 26 and 25.
6. ENDEX: Company team destroys MRB(+) as it attacks BP 3; or, when enemy reduces the company team to five vehicles, or less, during the defense.

ENCLOSURE B

BATTLE COMMAND/STAFF TABLES

ENCLOSURE B
BATTLE COMMAND/STAFF TABLES

All are concerned about the training of individual soldiers. They, in the last resort, determine the success or failure of the best plan. Yet when we think of individual preparation we normally concern ourselves with the proficiency of the Dragon gunner, the unit mechanic, and often the Platoon Leader. Seldom are the qualifications of the Brigade S-2 or the Battalion S-3 addressed both individually and as an integrated member of a team (Staff) advising the commander. However, on the complex modern battlefield of Airland Operations where sychronization of arms and services is essential, individual staff competence or incompetence leverages the battle to an extraordinary degree. The doctrine states the challenge well:

> . . . the only purpose of command and control is to implement the commander's will in pursuit of the unit's objective. The system must be reliable, secure, fast, and durable. It must collect, analyze, and present information rapidly. It must communicate orders, coordinate support, and provide direction to the force in spite of enemy interference, destruction of command posts, or loss and replacement of commanders.
>
> FM 100-5, *Operations*, p. 22.

As a result of extended experience at the Combat Training Centers and an excellent system of after action assessments, we know there are systemic deficiencies in command and control:

> In order to be successful, our commanders must improve in synchronizing combat power. The analysis and decision making process must be accelerated so that leaders at all echelons can make the right decisions rapidly. We must be able to project and anticipate so we can seize the initiative.
>
> Battle Command Integration Program
> Combined Arms Center, 09/89, p. 5.

Army training doctrine has acknowledged the problem by creating a series of training exercises designed to train commanders and their staffs. These exercises range from the traditional Command Post Exercise (CPX) and Tactical Exercise without Troops (TEWT) to new exercises such as Command Field Exercises (CFX) where operations can

be driven by new simulations such as Brigade/Battalion Simulation (BBS) or more commonly for reserve Brigades and Battalions, ARTBASS. Some combination of these exercises are mandated for units in proposed training programs by the National Guard Bureau and FORSCOM. For example, current guidance in FORSCOM/ARNG Regulation 350-2 requires that Battalions/Squadrons train in a CPX annually conducted with authorized simulations; same for Brigades although participation in a CFX conducted at higher echelon counts. The current TRADOC Combined Arms Training Strategy and the National Guard Integrated Training System describe a comprehensive strategy which ties together all the exercises and their enabling training support across echelons. So there is a clear need for command/staff training as well as an elaborate infrastructure of exercises to make it happen.

But what actually happens during the exercises? What specific training occurs in which sychronizing tasks when for the S-3? The answer is that it depends on Mission, Enemy, Troops, Terrain, and Time Available (METT-T) and the interest in staff training shown by the immediate commander or chief of staff.

Similar to the STX at small unit level, other than the process of Troop Leading Procedure--the Staff Estimate--the actual training experiences received by the staff are almost wholly dependent on the particular scenario. Training doctrine addresses necessary staff training as a byproduct of the Mission Essential Task List (METL):

> Staff training develops and sustains planning, coordination, and other staff functions relating to wartime mission requirements. Staff training objectives are derived from staff METL. For effective training, staff elements must train together within the same headquarters as well as with staff elements from other echelons within the organization.
>
> FM 25-100, p. 4-4.

Staff essential tasks are then defined in the ARTEP-Mission Training Plan of the particular organization undergoing training in the form of Training and Evaluation Outlines (T&EO). For example, a Tank and Mechanized Infantry Battalion Task Force is provided a Mission Training Plan 71-2 which has general T&EO at the Task Force level covering each of the Battlefield Operating Systems and generally describing the collective tasks, conditions and standards associated with general mission performance. For example, there are two T&EO for Fire Support: Employ Fire Support and Operate Fire Support Section. The Fire Support Section T&EO describes what must have been accomplished by staff planning to ensure effective fire support. In this case, an adequate Fire Support Plan which contains *inter alia*:

- Targets planned on known, likely, and suspected enemy locations; mounted approaches at choke points; dismounted approaches where acquisition is likely; potential enemy overwatch/support-by-fire positions; and easily recognizable terrain features to allow rapid adjustment onto the enemy.

- Smoke planned to obscure enemy observation, screen friendly movement, support breaching operations, and assist disengagements.

- Targets planned to support combat and reconnaissance patrols . . .

- CAS planned to engage concentrated enemy positions.

Task 7-1-39081, p. 5-119
MTP 71-2.

This is excellent and highly professional detail. Applied by well-trained units, leaders and staff members professionally qualified, the T&EO are outstanding. They will guide effectively analytical discussion among and between the S-3, S-2, and Fire Support Officer. Left with less trained units, there is considerable room for local interpretation--issues of "how much is enough" smoke, coverage of suspected locations, or concentrated enemy positions for CAS? These are detail issues but vital professional detail which when understood and shared enables Airland Operations.

How do we train this detail to the reserve staff officer in his or her professional development or those officers when they are grouped into the brigade or battalion staff? At present, aside from the professional support of a trained full time active soldier or reservist present to advise the preparation and execution of training, there really is no explicit training support. Doctrinal guidance is quite explicit that there are no staff drills which apply to this problem:

> Drills provide standardized actions that link soldier and collective tasks at platoon level and below. At company and above, integration of systems and synchronization of systems demand an analysis of METT-T.
>
> FM 25-101, p. 4-8.

Perhaps there is an answer in tables for basic command/staff training as there was for small unit training now that there are new technologies available and coming?

The technologies of distributed simulation represented in subsistent, virtual, and constructive simulation permitting immersion training in a warfighting context seem absolutely relevant to this training challenge. The potential has been described well in the draft Concept for Advanced Battle Simulation from the Combined Arms Center:

> ABS will allow users at many geographically separate sites to join together in a common exercise, force-on-force, against a common opponent, all using realistic tactics and capabilities in real time. Commanders, staff officers, and individuals on both sides plan, fight, and see the results of the battle or campaign. They see the cause and effect of sychronization: the interrelationships of time, space, movement, firepower, air support, intelligence, logistics, and the effectiveness of command and control systems. They can explore the gray areas between audacity and recklessness, paying for errors with the "lives" of their forces. They experience the frustration of human error, failed systems, and over-optimistic planning as well as the satisfaction of well executed missions.
>
> Para. 4A, 30 Oct 1990.

That is the potential of advanced simulation applied to division and above. Potential at that echelon is near reality at battalion. The training technology has been demonstrated by SIMNET in WAREX 03/90 with several battalions in the 1st Infantry Division. However, the training development which could relate the capability to the challenges of command/staff training in the reserves has not been done.

First, several characteristics of distributed virtual simulation (SIMNET) relevant to the command/staff training challenge:

- The simulation is fundamentally different from any other current battle simulation. As virtual simulation, it builds from the bottom up; that is, individual manned tanks, AFV and aircraft fighting absolutely "free play" on a terrain data base. Fire Support and Logistics are represented so the maneuver force faces realistic constraints. This capability is the basic SIMNET breakthrough in distributed virtual simulation--battalions of low-cost, generally full-crew simulators able to fight interactively against a realistic enemy also fighting to win. Now, the number of battlefield objects can expand to include in time virtually all the "drivers" of the battle for all seven battlefield operating systems--dismounted infantry, support vehicles, emitters, jammers--all of the important weapons which trigger staff action.
- As the numbers build, it is necessary to develop ways for the battle to be fought without the necessity of the presence of all the soldiers--particularly essential with the OPFOR. The answer is the Semi-automated Force (SAFOR) --essentially robotic forces or constructive simulation. At present, this capability exists so that one leader can command effectively in battle one U.S. company or an OPFOR Battalion. This capability should expand in time to one leader per U.S. Battalion or OPFOR Regiment. Successful SAFOR is the key to larger unit operations. It must be applied not only to larger maneuver formations but also to all of the other interactions of the other Battlefield Operating Systems. Several other capabilities or characteristics already proven

in SIMNET are particularly relevant to battle command/staff training. They are (in hardware):

-- ***Plan View Display(PVD)***--a real time "God-like" view of the battlefield permitting detailed overwatch or playback of the actions of the fighters portrayed on a terrain map similar to the NTC.

-- ***Stealth Vehicle***--the ability to move anywhere on the battlefield at any time in the battle without being observed. For example, an observer could place himself in the Company Commander's tank at the precise moment he ordered execution of an engagement area. Or the SAFOR MRB Commander could "beam" himself to the SAFOR unmanned Company Commander's tank and take personal command for the execution of a particularly important phase of mission execution. It is this capability for direct personal intervention "on the ground" to ensure that doctrine, tactics, techniques, and procedures are followed appropriate to infinitely variable Mission, Enemy, Troops, Terrain, and Time Available (METT-T) that distinguishes SIMNET from other constructive simulations created essentially by algorithm. Application of the high resolution described above for maneuver systems to other BOS will provide the capability for challenging "full up" command/staff training.

-- ***Data Logger***--the ability to record then analyze battlefield interactions to provide the detail required for command/staff AARs. Pre-established Measures of Effectiveness (inter and intra BOS) can be compiled rapidly while the command or staff action is still fresh in the mind of the officer or non commissioned officer. This capability can be quite detailed, which distinguishes SIMNET as virtual simulation from other forms of constructive simulation usually used to generate warfighting for battle command/staff simulations such as ARTBASS or CBS. The detail of potential AAR data is remarkable. The following listing of potential MOE focuses on Maneuver, Fire Support, and Command and Control. Other Battlefield Operating System MOP can be developed to support command/staff training.

Potential Measures of Effectiveness
Kills by type by shot--Abrams, Bradley, T72.BMP Total hits at 90 degree aspect ± 45 degrees Blue/Red % ATGM, % Tank Total hits at 180 degree aspect ±45 degrees Blue/Red % ATGM, % Tank Commander locations at critical times--BDE/TF/Company Planned critical times and locations vs actual--major units Commander BDE/TF/CO% time under direct/indirect fire
Effectiveness of direct fire from key locations % targets acquired % targets engaged of those acquired % targets destroyed of those engaged % fraticide
Effectiveness of indirect fire from __ Battery, ___ Mtr Plt % targets engaged of those requested by Commander most/least responsive times, average % targets neutralized of those engaged % targets destroyed of those engaged % time main effort observable by FIST
Effectiveness of suppression at key times in Cmdrs plan Artillery: % of Hhour capability capable of firing, % firing Atk Helo: % of Hhour capability msn ready, % fighting
Effectiveness of Recce % possible targets acquired > 5 km fwd of friendly trace % targets engaged by Fire Support
Effectiveness of Counter Recce % Regt Recon Co neutralized
Terrain Use Average distance between vehicles at key locations % AFV able to engage enemy max effective range at key times in Cmdrs plan
Massing of Combat Power (Blue/Red) % combat power employed at key times in Cmdrs plan (% initial combat power, %remaining-direct/indirect fire)
C2- Troop Leading Procedures Time Div, Bde, Bn, Co orders Reporting: Co to Bn then Bn to Bde.then Bde to Div.
Processing time--mean,mode,average Accuracy of spot reports: reported vs actual Reporting discipline--cueing critical messages Time cmd vehicle able to observe main effort
Synchronization use of Attack Aviation Time ABC enter net to initial engagement Effectiveness of SEAD--% ADA engaged, % neutralized Effectiveness of Atk Avn use--% target engaged, %hit
Effectiveness of CSS Class III % force green/amber/red/black by hour (M1, M2-3, Atk Avn) Class V % force green/amber/red/black by hour (Tank main gun, TOW/25mm,155) Maintenance: time AFV inoperative until BDA present Medical: time casualty until Medics present Approach March: Cl III status

The utility of hardware capabilities (Data Logger) for battle command/staff training seems evident. These MOE examples just scratch the surface of the kinds of detailed information which could be made available routinely for the unit in training potentially at any echelon. This detail available for unit AAR is complemented by the basic nature of the simulation:

- The simulation is unforgiving. Since there are virtually no black boxes solving problems and the simulation builds and aggregates from the individual fighting element up, warfighters and their staffs must coordinate in detail exactly as they would on the battlefield. If integration of combat power is good, the battlefield outcomes reflect that. If it is poor, unfocused, that too is evident. As some BOS are fought in the automated or semi-automated (SAFOR) mode, the software which establishes the battle context (OPORD) and the machine ground rules (Combat Instruction Sets) are readily available and easily changeable to reflect particular doctrine, tactics, techniques, and procedures desired by the chain of command.
- All actions are "free play" actions of war fighters and their staffs fighting to win. As a result, the development objective is no scripters for IEW, OPFOR, etc., and fewer to no Observers/Controllers as the analytical data required for chain of command assessments will be readily available in the Measures of Effectiveness (MOE) for each Battlefield Operating System (BOS). This can be observed by Stealth, viewed on the PVD, or compiled on the Data Logger as discussed above for use in AARs.
- Overhead should be modest as the major participation required is that of the fighters (command and staff) occupying their TOE positions who are striving to achieve the objectives stated in their OPORD using the doctrine, organization, equipment (embedded in actual equipment through subsistent or virtual simulation when possible), and training of their actual unit. The major training variable is the level of command/staff participation desired by members of the unit at whatever the echelon.
- The distributed nature of the simulation combined with the Stealth capability permit the CAPSTONE commander to transit to the battlefield of virtual objects at will. He may be able to "visit" command groups of subordinate commands--talk to the commander and view that commander's decision graphics. The senior staff officer can visit the higher or lower appropriate staff electronically. As a result of the inherent flexibility of distributed virtual simulation, it appears clearly possible to sustain immersion training in a warfighting unit context for battle command/staff training.
- The most powerful feature of distributed virtual simulation is that for Commanders, key staff officers, ALOs, FISTs, Fighting Vehicle Crews--

where ever you choose to put man in the loop--there is a visual portrayal of a seamless, virtual battlefield. Commanders can see combat formations moving and make realistic calculations for synchronizing time and space and make on-the-spot adjustments to battle plans. Artillery and air strikes can be adjusted if the man in the loop is properly positioned to observe. The location, effectiveness, and possible enemy countermeasures can be directly observed. The positioning of vital air defense fire units can be checked out "on the ground." The experienced officer can judge if the movement to battle positions by attack helicopters is taking advantage of terrain and if the resulting exchange ratios are valid. *The whole issue of "validity" of battle simulation goes away because professionals can "see" what is happening and instinctively know if it is realistic.*

Thus summarized, distributed virtual simulation seems to be a technological opportunity to fill gaps in command/staff training. Since objects have to move on the ground in great numbers to cause events to happen--there are no face-saving algorithms--the friction of war can be genuinely present. New capabilities such as sensors or command and control improvements or Terminally Guided Weapons can be integrated and fought.

Given this apparent technical suitability of simulation for rigorous command/staff training, Command/Staff Tables analogous to the small unit tactical tables appear feasible. Conceptually, to achieve the level of resolution of "how to" required to support the T&EO for the unit staff discussed above with fire support, a series of increasingly difficult situations should be presented to the individual and staff in such a way as to cause considered action (coordination) to occur. Then that action is discussed in depth in an AAR. There is precedent for this approach. The Fire Coordination Exercise (FC 71-5, Armor School, January 1985) is a proven command/staff table developed to better train fire support tasks in both institution and unit. Nineteen specific vignettes to fixed METT-T are presented in "what now" situations followed by AAR.

The stimulus for the table can be either a series of vignettes drawn from Desert Storm, Brave Shield, BCTP, NTC, JRTC, or CMTC presented in a "What Now, Commander, or S-3 or Fire Support Officer etc?" mode, or the battle vignettes could be drawn from special situations with carefully selected METT-T designed to bring out critical training points. Excellent check lists for staff responsibilities requiring training in tables are included in the ARTEP-MTP T&EO. In addition FM 71-123, *Tactics, Techniques, and Procedures for Combined Arms Heavy Forces*, is a good primer on "how to" by Battlefield Operating System by type unit mission.

Following the tactical tables precedent, battle command/staff tables could consist of three general groupings of exercises. The groups are designed to stimulate training--Lessons Learned--at three well-known levels: (1) basic BCTP-type lessons that staffs have to learn again and again pre mobilization; (2) more advanced lessons that well trained troops can absorb and thereby gain increased competence as they undergo post mobilization training; and finally (3) lessons of truly advanced teamwork that when mastered mark only the best of fighting units. See Table 1, Enclosure B, for a brief description of the concept.

BATTLE COMMAND/STAFF TABLES

Basic Coordination Exercises

These are tactical vignettes oriented either to vertical coordination within a BOS or to effective horizontal staff actions required to accomplish various missions. A vertical vignette could be as straightforward as uninterdicted Class III and V resupply in a Brigade hasty attack (drawn from BCTP experience and recreated in virtual simulation) where all the CSS planners and operators from maneuver battalion to division work the issue with other BOS represented by SAFOR. Alternatively, the vignette could be as complex as massing fire support for counterfire during a rapidly changing offensive operation, as occurred on Desert Storm. In this case, all of the Fire Support Coordinators from battalion to division including Corps Artillery assets could fight with a "canned" METT-T set up in virtual simulation with other BOS in constructive simulation (SAFOR). The canned situation would be designed to bring out the challenges in fire support planning represented in the ARTEP-MTP T&EO in great detail to ensure common professional understanding. Essentially, it could be an upgraded Fire Coordination Exercise (FCX).

A brigade echelon vertical vignette could focus on IEW--Preparation of the Battlefield--orchestration of intelligence collection assets battalion through division then "canned" METT-T execution with all of the Intel capability fighting manned in virtual simulation while other systems fight in SAFOR--essentially an Intelligence Coordination Exercise. Again the METT-T is fixed to ensure that the most productive training required in the ARTEP MTP is achieved. AAR would be conducted as desired probably upon completion of a critical phase or every one to two hours if the table is designed to be "fought" in a UTA 1 (four hours). The AAR would be tied very closely to known CTC shortfalls in achieving ARTEP-MTP standards. The nature of the simulation provides the flexibility such that virtually any training technique desired by the unit could be supported.

Table 1, Encl. B. Combined Arms Tactical Tables

COMBINED ARMS TACTICAL TABLES

Basic Coordination Tables

- Review coordination of basic Staff Procedures vertical by BOS and horizontal by echelon-- Bn/Bde
- Full staff--all BOS supported, no degrade to capability
- Minimum OPFOR (SAFOR)to stimulate cmd/staff action
- Crawl, walk, run to standard--more difficult conditions

Staff Actions Tables

- Train coordination of priority combined arms collateral operations
- Full unit-all BOS manned, no degrade to capability
- Competent, aggressive OPFOR "fighting to win"
- Stress all BOS, embedded AAR

Command/Staff Reaction Tables

- Intense,demanding tactical situations requiring quick, innovative responses
- Degraded mode by BOS-key personnel casualties, logistic shortages,
- OPFOR(SAFOR) advantage, challenging missions
- Stress joint and combined coordination under challenging conditions

BATTLE COMMAND/STAFF TABLES

These tables are designed to develop mission-ready battle staffs--Cmd Gp and TOC by requiring demonstrated proficiency to standard in increasingly complex operations. They draw on the SIMNET/CCTT technology, which permits variable resolution in the representation of the BOS. Plan View Display, SAFOR, Stealth Transporter, and Data Logger are all integrated to provide timely AAR feedback to Command and Staff in agreed MOE to predetermined METT-T by BOS.

POTENTIAL

- Opportunity to fight your Contingency mission on that terrain focused by echelon or by BOS.
- Through seamless simulation and variable granularity, fight with your force actually "on the ground"--many objects(tanks,trucks, emitters, etc.). All must receive timely command/ staff direction, just as in battle.
- Semi automated Forces (SAFOR) permit major units to be fought with minimum personnel. Key battle decisions at subordinate echelons are human. Distributed simulation is supportive of distributed RC units or coalition allies.
- Technology developments should permit hybrid simulation where a CFX could be conducted with some fighting from actual vehicles while others fight from simulators and others are in a CPX or classroom environment.

Horizontal vignettes would focus on training the full staff at the selected echelon at battalion or brigade in the Basic Coordination Exercises. The METT-T of a particular mission "fought" on Desert Storm or at CTC could be recreated as of H Hour with full battalion command and control distributed as described in doctrinal publications. Then the battle begins with brigade and company and below represented by SAFOR. The simulation technology would permit "refight" of that mission followed by detailed AAR incorporating the MOE as desired by the battalion commander. Now the focus would be on coordination of command/staff to the ARTEP-MTP T&EO. Then should the chain of command desire, another warfight could be conducted perhaps executing another course of action but again reinitialized to the same METT-T as the preceding mission. In all cases, the overhead would be reduced significantly by fighting brigade and above and company and below in SAFOR.

If desired, the technology would permit development of a "standard" battalion or brigade operation with METT-T laid out by the Combined Arms Center and well-documented ORLL. This operation, analogous to the school solution "par" for the tactical tables, could be made available to newly assigned Brigade Commanders on a distributed basis so that they could "calibrate" their command and staff procedures. Competition could also be encouraged to "beat the par". Once the TRADOC or Major Command METT-T is initialized, the brigade could vary the manned/SAFOR mix as desired.

Staff Actions Exercises

This group of exercises would be considerably more challenging than the basic in that more complex collateral operations would be fought against a more aggressive and capable enemy and the full flow of operations would be permitted to develop. That is, the trigger for command/staff action would not be "canned" vignettes but rather a free-flowing campaign or battle which, given the general correlation of forces, could be "won" by the OPFOR if the friendly force (battalion or brigade) is not fought well. The AAR process using detailed MOE developed for the Basic Coordination Exercises would be available but used to reinforce the chain of command as it trains itself not through any intermediaries such as O/Cs. At this level, missions would be complex involving multiple collateral operations. An example could be brigade delay against division size forces with corps priority for fire support and mid-battle OPCON of an Allied force. All BOS would be fully mission ready at the onset of operations. At the battalion echelon a comparable mission could be battalion hasty defense against a multiple brigade-size force with division priority

of fire support. Such a mission would stretch the command-staff capability to focus combat power.

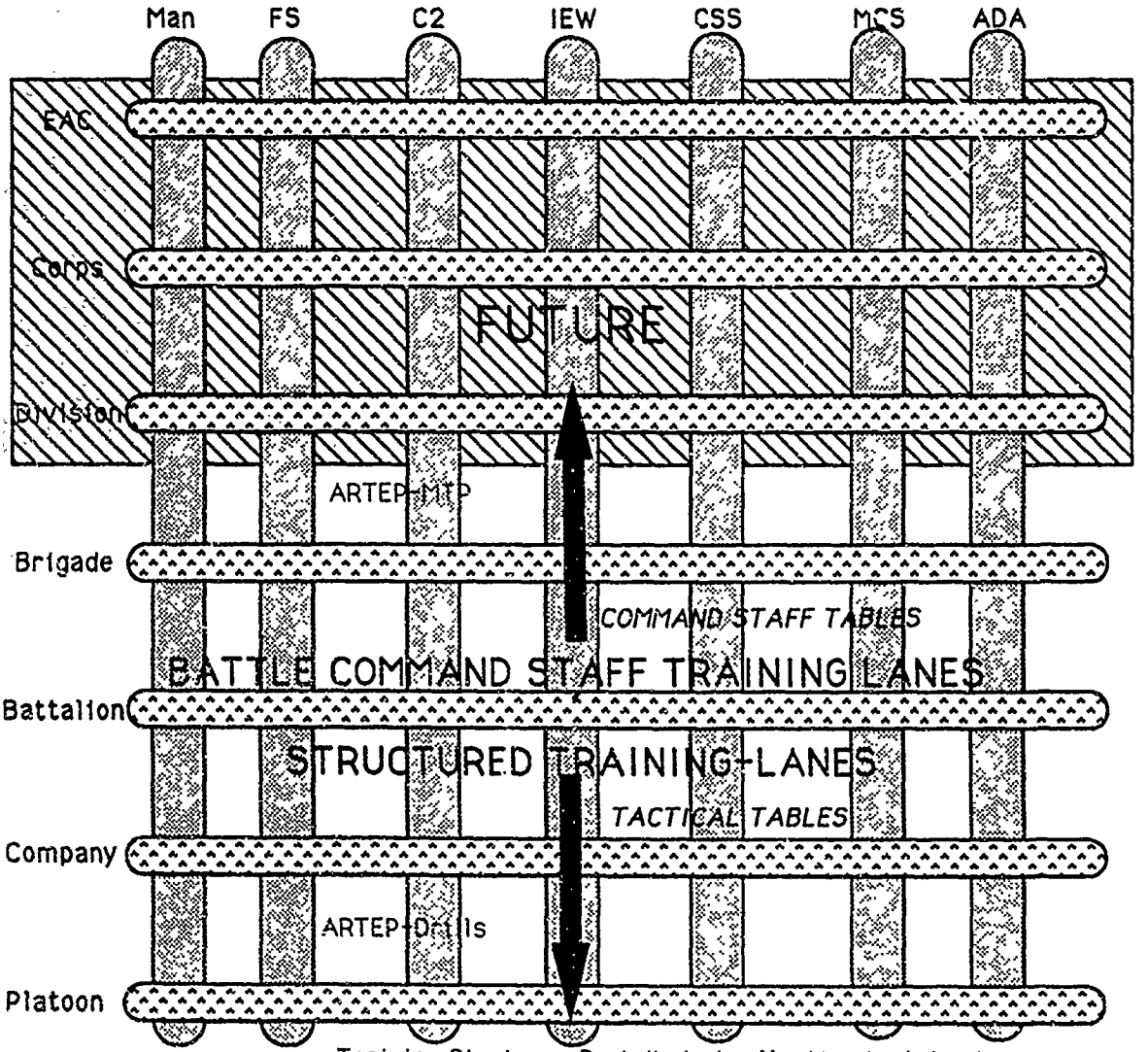
Command/Staff Reaction Exercises

Reaction exercises would be extraordinarily challenging, requiring a level of teamwork and capability in focusing combat power well above the average. These are the lessons of truly advanced teamwork which can be represented only in distributed simulation technology. Each battle could be complex, involving major OPFOR forces with reduced friendly capability and the initiative resting with the OPFOR. Joint and combined forces would be an integral part of all contingency scenarios being "fought." An example could be a reduced capability brigade hasty defense against a division with enemy fixed and rotary wing superiority and a severely constrained friendly logistic capability. Friendly personnel losses during the operation would include one or more commanders in the brigade. At the battalion echelon, a delay against larger OPFOR forces with limitations in selected friendly BOS could be a suitable Reaction Exercise. Other similar scenarios would stress BOS coordination within the division/brigade/battalion dependent upon the training requirements of the chain of command. All three of these sets of tables should be capable of execution in any combination of virtual and constructive simulation desired by the chain of command. The training and technology should permit a broad range of personnel requirements dependent on the training audience. See Table 2, Intensive Training Matrix.

These examples hopefully reflect the significant potential for remarkable improvements in AirLand Operations command/staff training permitted by distributed simulation for both unit and institutional training site--Battle Command/Staff Tables. Detailed development of this training is beyond the scope of this effort. It is included to indicate that the methodology applied to small unit and leader training appears equally applicable to command/staff training. The training support recommended, particularly the Commander-Staff Trainer, should enable this necessary training.

Table 2, Encl. B. Reserve Forces Intensive Training Matrix

Fighting vertically by BOS or horizontally by echelon with mix of personnel and automated participation as desired by chain of cmd



Training Strategy: Distributed collective training to pre determined METT-T by echelon or by Battlefield Operating System, enabled in the Armory or Reserve Center by distributed virtual simulation. Very intense immersion training package provided to the chain of command by doctrinally correct Tactical Tables and Battle Command/Staff Tables combined with embedded AAR support. Chain of command determines degree of automated support ie if training Fire Support, all from that BOS present, other BOS could be constructive.

Echelon

BOS

TAB 2 ENCL B

ENCLOSURE C

STRUCTURED TRAINING

ENCLOSURE C
STRUCTURED TRAINING

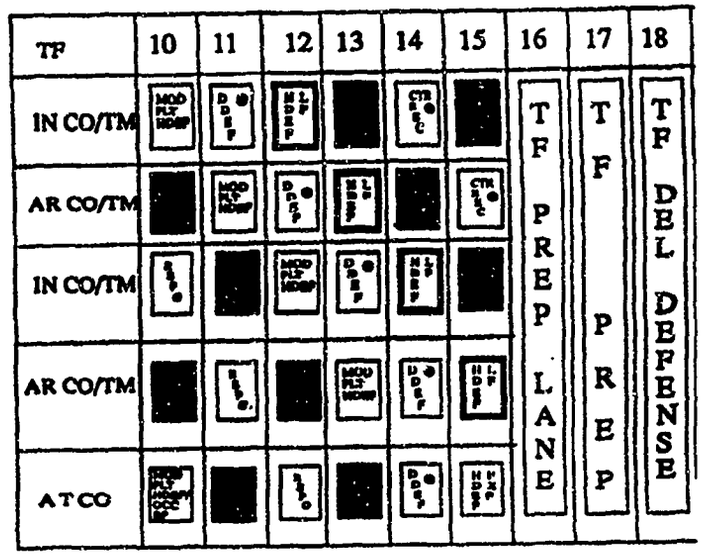
Structured training is individual or collective training in the institution or unit which is accomplished with unusually intensive training support to achieve a particular training objective such as reducing the time required to train to task proficiency or ensuring proficiency under unusual conditions.

Lane training is structured training applied to collective unit training.

> Lane training is a technique for training primarily company team-level and smaller units on a series of selected soldier, leader, and collective tasks using specific terrain. Lane training uses multi-echelon techniques *to maximize the efficient use of limited terrain and control conditions for formal or informal evaluations.* Lane training is externally supported, resourced, and evaluated. It enables similar units to simultaneously or sequentially train to standard on mission-related scenarios. *Lane training is resource-intensive, so commanders must maximize its benefit.* They narrow the focus and select only the most critical METL or collective tasks for training. . . . (Emphasis by author)
>
> FM 25-101, p. 4-8.

Lane training was employed at the National Training Center and by III Corps in training the Guard roundout brigades for Operation Desert Shield. This schedule of NTC unit training is typical:

UNIT TRAIN-UP LANES
10 DAY MODEL - DEFENSE



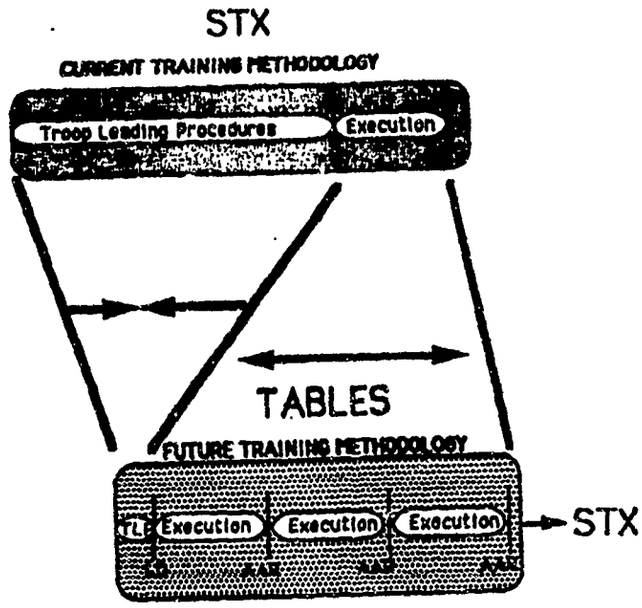
Each Company trains to a specific mission each day. Each of these lanes is provided Observer/Controllers and a closely controlled OPFOR to ensure consistent quality training. Since the Mission, Enemy, Troops, Terrain, and Time Available were controlled uniformly, as is generally done in lower echelon institutional training, these exercises could be fairly called tables as we have defined them above, not STX. This type of controlled lane training has been conducted with Guard units over the years. For example, both heavy platoon and company-size units from the 34th and 38th Divisions and light platoon and company units from the 73rd Brigade participated in lane training several years ago. The training has been acknowledged as both efficient and effective for unit training at AT. It is now being adopted by FORSCOM in its intensive RC training enhancement program--Bold Shift. Looking back from the discussion of training exercises, these lanes were in fact tables in that the METT-T was fixed for purposes of controlling and increasing the quality of the training. Of course, the overall training problem is far larger than AT. A more general answer is needed.

Structured training is also routinely applicable for individual training. Armor platoon leaders are trained on lanes in the AOBC "Ten day war" and much institutional noncommissioned officers training is structured. And it is used commonly for weapons qualification training where task proficiency must be achieved with a scarce resource (ammunition) and there is immediate danger. There is a great amount of structured training

ongoing today. Note, however, that much of the structuring which occurs in the active force is associated with drawing on additional trained personnel beyond those assigned to the unit in training to ensure quality (OPFOR and O/Cs) and centralization--externally supported unit "County Fair" training and the like. Due to the dispersion of units, neither is as feasible for reserve forces as it is for active forces but the need is no less great. So a challenge is to develop other reinforcing support for reserves which can enable consistent highly time-efficient training similar to the current lane training but which is more applicable to the total training requirement from home to armory to LTA to MTA to RC BTC.

Structured training has real advantages for reserve forces but there are serious pitfalls. First the advantages many of which are associated particularly with table training exercises with their "frozen" METT-T:

- The precision of task, condition and standard added to tailored METT-T to focus the unit in training permits very finely tuned, targeted training. The tactical situation or vignette can home in quite precisely on high priority tasks.
- Structured training can enable very complex training often beyond the capability of the average unit. Just training target acquisition to battle ranges of several thousand meters (TOWs and AFV) can be very difficult for the average unit. New equipment such as directed energy or extended operations with helicopters requires elaborate training support.
- Structuring to economize time results in organization of increasingly costly OPTEMPO--the fuel, ammunition, and spare parts associated with training on modern equipment.
- As the training is focused it is amenable to increased quality control. Probably the best examples are AFV gunnery tables which are noted for quality control by a combination of human and mechanical means. "Freezing" METT-T in tables channels doctrinally correct training to roughly comparable actions particularly at the basic levels of proficiency in training exercises for distributed execution in subsistent, virtual, or constructive simulation, as well as equipment live fire. Tables can have "par" performance expected. In addition, more precise Measures of Effectiveness embedded in AARs further reinforce quality control. Of course, this quality control can be distributed up and down the chain of command as a byproduct of the training and technology development associated with distributed simulation.



- The greatest benefit of structuring is the opportunity it permits for compressing the training. It can either increase the efficiency of the training process or decrease the time or both. Note the time consumed in STX training for Troop Leading Procedure. If we can reduce that, equal or less time could result in more immersing "battles" and solid AAR training between executions. In the situation shown, we assume that Troop Leading Procedure has been trained prior to the exercise, therefore the commander decides to train using a table such as Hasty Attack-Company. The METT-T is fixed, the unit is placed into a battle vignette to face a series of known events (enemy or friendly) and the unit's challenge is to demonstrate proficiency to known task, condition and standard. The measures of performance for the AAR are also known in advance. As indicated, this unit completes three quick table "battles" with solid learning in the AARs and the satisfying opportunity to demonstrate improving proficiency to soldiers as they fight and refight the exercise. By drawing on the table exercises, the unit has been able to have three "battles" with the benefit of AARs and the challenge, satisfaction and clear training benefit of "doing it again, better" in a period of time that would have permitted one battle in a conventional STX exercise.

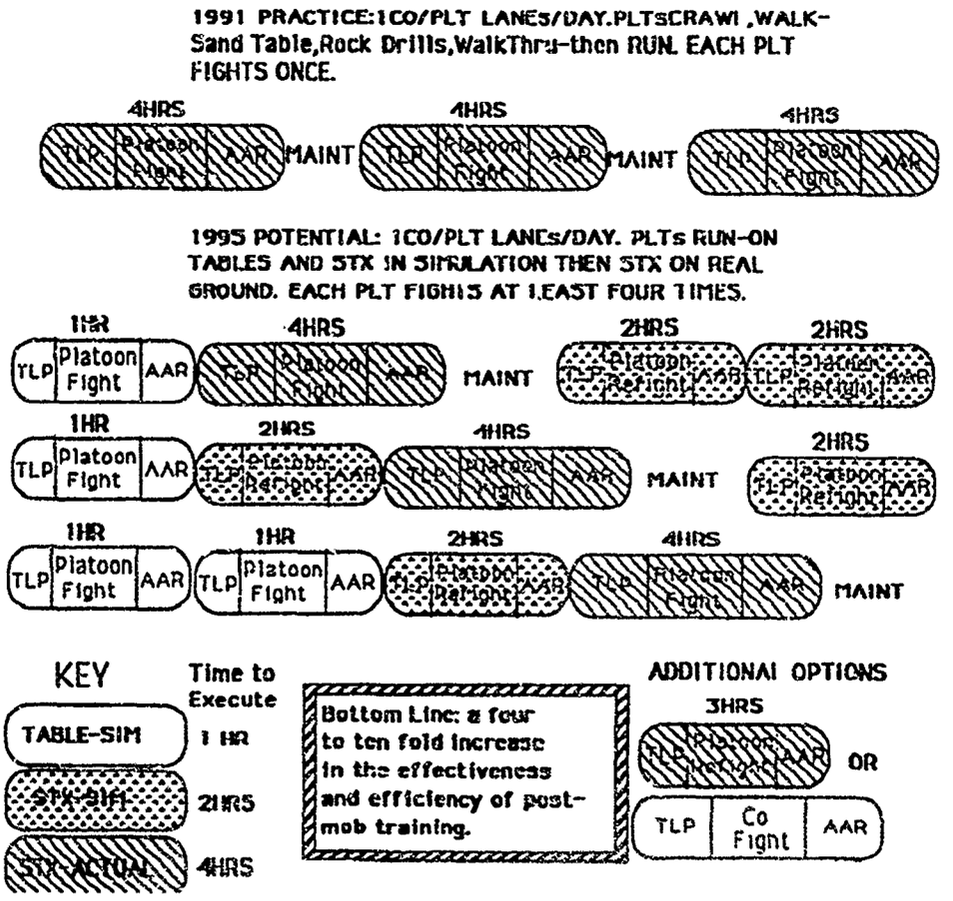
Having completed these three "battles" in virtual simulation in a UTA 1, the company commander could then execute a company hasty attack STX late Saturday afternoon or proceed to another table, perhaps a company movement to contact in preparation for platoon STXs movement to contact to be trained by the platoons Sunday morning on equipment at the unit WET site. The combinations are endless. The point is

that the unit commander has been given highly efficient training, and his higher chain of command knows exactly what he is training during that UTA 1. In fact, with distributed virtual simulation, they might use Stealth to observe the table training from battalion. Use of the "two-way" capability of distributed simulation is a decision of the chain of command. There are times when it is wholly appropriate to be "looking over the shoulder" of subordinate unit training--as in external evaluations. There are other times when the small unit training should be unobserved, completely in the hands of the young leader as he or she is left alone to train their subordinates with the resultant pride and satisfaction of achievement.

There is another aspect to the opportunities to compress small unit training offered by the combination of tables and STX as well as the flexibility of subsistent, virtual, and constructive distributed simulation. That is, the ability to mix and match exercises to make the most efficient use of training opportunities. There are four major small unit training alternatives other than live fire, which is clearly necessary but is a training exercise of limited application due to safety range requirements. The four combinations widely available are: table exercises in simulation or on the ground on AFV and situational training exercise (STX) in simulation or on the ground. The shortest and most conserving of time and OPTEMPO is the table in simulation as was employed by the unit commander above. The most costly in time and OPTEMPO is the STX on the ground. However, this latter training exercise, expensive as it may be, is the bottom line particularly when it can be executed live fire for it most closely represents the terrain, weather, and intense equipment orientation of the mounted soldier in combat. Intuitively, we know that there are broad training effectiveness tradeoffs among and between these four alternatives. Training effectiveness analyses will be required to determine the "best" ratios, but major compression opportunities are clearly there.

The diagram below portrays one potential situation. That is, the training opportunities associated with replacing a conventional day of platoon lane training on the ground in STX--a schedule typical of the training of the 48th Brigade at the NTC during Desert Shield--with the mix and match of exercises discussed above. This representation uses only tables and STX in simulation and STX on the ground. There could also be tables on the ground. For purposes of representation, a table in simulation requires one hour, a STX in simulation two hours, and an STX on the ground four hours. Actual times depend on such factors as the mission, the design of the tables, and the detail of the AAR, but the relative times are correct based on personal experience executing structured lane training on

the ground and in SIMNET. Note also the distinction between fight and refight. Refight means the second or additional opportunity to fight the same exercise with the attendant opportunity to intensify the training benefit.



Another aspect of structuring training to achieve compression is the ability to design or "structure" the exercise to permit its execution in several locations. For example, we normally associate demanding STX training with at least an LTA if not an MTA training area. By employing distributed virtual simulation, we can shift the locale to permit solid table and STX training in the armory. It is highly unlikely that high resolution simulation required for full combat table execution will be affordable for distribution to all company armories. Therefore a challenge to executing distributed table training in simulation will be the training development required to develop part task tables for armory execution on Abrams/Bradley Trainers or Instrumented Abrams/Bradley. In addition, as battle command/staff table training requirements evolve, we may be able to enable this training in

the home or individual work place with constructive distributed simulation displayed on a Commander-Staff Trainer developed to present the proper cues to the individual viewer. Once we can begin to shift the locale of the training, we can really design the training for increased intensity. An exercise associated today only with AT at an MTA could be trained and retrained part task during IDT. Then if the task is one that requires demonstrated proficiency on the ground, the unit can complete the remainder of the training--that not included in the armory part task training--quickly at AT and move on to other tasks such as continuous on-equipment operations for several days honing mounted soldier field crafts--a training challenge in the Desert Shield train up. That prolonged field time could only be available if much of the training currently associated with AT had been transferred to IDT training.

- Structuring training also can cause important personal development (both training and education) to occur with some precision. As indicated above, a training shortfall in Desert Shield was that some Guard combat units had not been able to spend enough time actually on AFV to really feel comfortable maintaining and preparing equipment for combat. It is entirely possible to design structured training where the individual or crew is presented typical tasks which must be performed to standard complete with AAR. Repairing a thrown track, battle damage field expedients, vehicle recovery, prepare to fire drills--all are amenable to structured training. In fact, faced with a similar problem some years ago, the Armor School organized a series of important but seldom trained tasks into a Table Exercise--the original Logistic Coordination Exercise--which consisted of infrequently trained but important battlefield logistic tasks such as recovery and care of dead, refueling from cans, night LogPak procedures, and emergency crew drills for AFV. Young leaders were required to perform these tasks to standard with AAR. That is structured leader training. Also, state training should be amenable to the same training techniques.

In World War II there was considerable difficulty training soldiers to care properly for their equipment. To remedy this, Hollywood prepared a Training Film, "The Late Company B," which consisted of vignettes of training such as vehicle maintenance and weapon maintenance, even the proper break in of boots. Then the movie presented battle vignettes showing situations where soldiers were killed because of a specific deficiency in basic training. The training failure was related explicitly to battle failure. That was a way to train procedures and standards using movie technology. Today we can design the same in virtual reality or in on-the-ground structured training situations. As simulations improve, we should be able to create very stressful situations for battle conditioning such

as major damage and injury on an AFV requiring almost reflexive response. Just as is being done in recreation of the Desert Storm Battle of 73 Easting, realistic simulation virtual realities are coming.

Structured training is a way to focus training to very precise results with involved, immersed individuals and units. Much of the discussion here has related to small unit training. The logic is equally applicable to leader and command/staff training. In fact, much institutional leader training already is heavily structured.

Now to the pitfalls of structured training. First it is quite expensive--expensive in the needs for detailed training development followed by extensive training support so that quality structured training is available when and where it is most useful to the chain of command. Costs in OPTEMPO can go up or down. Down as the unit, much better pretrained in structured simulation or on-equipment lanes, can train more efficiently and effectively full up in STX or FTX to mandated proficiency. Up as the better trained unit strives to move from basic exercises to expert levels. As the unit trains better, it wants to do more. Of course, that unit interest and enthusiasm will attract and retain better people as the unit trains better--clearly what all wish to achieve. Also, conserving dollar or people costs was not the primary objective of the program; saving time while conducting quality training was the purpose.

A second problem is more subtle. As the training schedule itself becomes increasingly structured with mandated events, young unit leaders can feel hemmed in. Unable to design the training as they would like--or so believing--they resent overcentralization. There are two general responses to this problem. First is chain of command participation in the training management process prescribed in FM 25-100. Long and short range planning and programming encourage junior unit leader involvement. Second is the quality of the training. Outstanding immersion training in tasks clearly necessary to success on the battlefield develops competence and confidence. In any event, if multiple repetitions of exercises are designed into the UTA, the commander will have an opportunity to modify exercises to ensure that his or her particular concerns are addressed.

The shortfalls appear to be more than compensated by the manifest advantages of structured training. The challenge will be how to incorporate it into a sensible training program doable by the average unit facing the average training support environment.

TRAINING PROGRAMS

The end product of both training and technology development must be the small unit, leader and battle command/staff at battalion trained to objective mission proficiency prior to mobilization. The program should sustain individual soldier proficiency and it should provide a command/staff training program relevant to basic proficiency up to brigade level. It will not provide initial skill training to the individual--the responsibility of the active army institutional training base, not the National Guard--nor will it fully prepare the brigade staff. Many of the brigade training requirements are derivative of the division not building from the company as at battalion. Brigade training must look to higher echelon formations and doctrine. All this is important training, but the cutting edge is the small unit which must be well trained for ultimate success. Not only are platoon and company the most important echelons but also by their distributed nature, companies and platoons are the pacing training challenge. Therefore the focus now is battalion and below with particular emphasis on the platoon for pre-mobilization training proficiency.

As we contemplate the challenge of describing future small combat unit training programs with an order of magnitude improvement in both effectiveness and efficiency of training in comparison to today, we survey a substantial array of support:

- The training requirements are defined clearly in Soldiers Manuals and ARTEP-Mission Training Plans backed up by an elaborate training infrastructure in TRADOC, the National Guard and FORSCOM Readiness Groups.
- The Total Force training doctrine is excellent. The process prescribed in FM 25-100 and 25-101, reinforced by the Combined Arms Training Strategy, is proved in combat and at the CTCs.
- The National Guard Bureau and U.S. Forces Command have prescribed specific training requirements which have in turn been translated to National Guard unique requirements and training support such as Guardfist. This is being expanded by the current FORSCOM Bold Shift programs.
- All above has been assessed recently in the crucible of actual precombat training for both Army and Marine heavy force units. The Marine train up was tested and found successful in combat on Desert Storm.

So this effort is far from starting from scratch. The challenge is to add to, to reinforce, to place needed new capabilities in the hands of the chain of command. New ingredients which appear necessary to achieve the "breakthrough" training program during this decade are:

1. Prioritization of training tasks as was done at the NTC for the Desert Storm train up.
2. Adoption of structured lane training as the primary technique for intensive training of small units, leaders and battle command/staffs.
3. Design training in an immersion unit-in-battle context employing tables and STX to the platoon echelon and combined arms tactical tables and STX at company. It would appear to be an appropriate objective to expect that heavy force units could eventually demonstrate combat table proficiency on a continuing basis--perhaps even years Gunnery Table XII (Platoon) and Tactical Table I (Platoon) and odd years Gunnery Table VIII (AFV) and Tactical Table L (Company). Staff training could be conducted with Battle Command/Staff Tables. Other exercises such as the Field Training Exercise (FTX), Fire Coordination Exercise (FCX), and Command Field Exercise (CFX) would be incorporated as appropriate to maintain the warfight context.
4. Develop low cost free-standing, equipment-appended and table-top simulators capable of providing effective training in subsistent, virtual, and constructive simulation and linked by low-cost distribution to armory and eventually to the home.
5. Develop new training techniques and exercises to improve individual immersion training (such as the Living History in virtual reality from Desert Storm for battle seasoning); leader pre-training for the execution of table training which is also applicable for leader training in the institution; and intensive AARs for execution by the chain of command.

The ingredients will need to be supplemented by extensive training development--not only involving the writing of the individual tables but also to assess the frequency of training required to sustain basic proficiency in the average unit; the best allocation of training exercises between armory, WET or LTA, MTA and RC BTC; and the tradeoffs between the various exercises. What is the best mix of table and STX in simulation and on the ground? This training development requirement is applicable for leader, small unit and battle command/staff training.

Several alternative training programs should be prepared for evaluation initially at platoon and company then at battalion. The training programs could look generally as follows:

- Unit programs during IDT could consist of a mix of on-equipment lanes in live fire and subsistent simulation including intense individual and crew "mounted warrior" field craft lanes. COFT-type precision exercises and platoon /company tables could be fought in virtual simulation with chain of command

table pretraining in constructive simulation. During AT, the unit could live in the field engaged in continuous combat in a combination of tables and STX on terrain and in virtual simulation from a field location. As even year training, combat gunnery Table XII could be fired live fire after pretrain in subsistent and virtual simulation in IDT (part task) and in the field at AT. This could be complemented by execution of combat tactical table I which had been fully pretrained in IDT.

- During IDT, battalion command/staff training could consist of selected Basic Coordination Exercises from the command/staff tables fought in virtual and constructive simulation. During AT, the Battalion should command subordinate companies in their execution of tactical tables and STX in virtual simulation. The Battalion Commander would conduct the AAR for the Companies.
- Leader training could incorporate the new exercises and devices in a intensified RC AFV Vehicle Commanders Course for vehicle commanders of all grades and the RC BNCOC CMF 19K and 11M modified to intensify the training. If feasible, design a Combined Arms Heavy Unit Commanders Course trained entirely in tactical tables and STX in virtual and constructive simulation.

These broad training programs should serve to lay out the challenges associated with more extensive implementation. The various piece parts should be evaluated separately before they are combined in one unit. A comprehensive evaluation plan is required to lay out and evaluate the critical path events--training and technology development--in both Proofs of Principle and Training Effectiveness Analyses. Annex D.

It is difficult now to describe the objective training programs due to the certain unanticipated breakthroughs and disappointments during the several years of development. Nevertheless, a broad sketch of an objective small unit training program is appropriate:

Assume a Tank Company IDT MUTA 4 at the Armory with a small WET site 2 km by 3 km nearby (30 miles). One platoon of tanks is maintained at the WET site for two line companies. The other tanks are at the MATES. Training has been coordinated so that the Company we are observing has exclusive use of the WET site this IDT.

The Company Commander has decided to train Platoon Attack this weekend in preparation for Platoon lane training to be conducted during AT by Battalion at the RC BTC. He moved his Abrams Trainers (10 to equip the entire company less crews actually on tank--these rotate among the Tank Companies in the Battalion) to the WET Site Friday. The MUTA 4 has been divided up into several major events for each Platoon.

The first platoon comes in Friday evening and crews the 4 actual tanks. They will be on-equipment "fighting" in a succession of structured lanes as late as possible on Sunday. Their tanks have been instrumented so the fire control and vision blocs can port into the virtual battlefield the rest of the company is fighting on or use the actual WET site terrain. Their entire weekend consists of tactical tables on terrain including PreCombat Checks, operational and organizational maintenance drills including recovery situations and tactical resupply. The local Readiness Group provided an experienced E8 to assist the Platoon Leader in conducting AARs on the tables although the Platoon Leader had trained on these same tables when he attended the RC TCC and feels well prepared to train and evaluate them. The platoon executes platoon drills and tactical tables on the ground, day and night. When one or more of the other platoons or the company trains attack tables in virtual simulation, the platoon can observe and participate interactively from a stationary position. The remainder of the time they maneuver their tanks changing off crew positions to hone on equipment skills. They lagger tactically both nights.

The second and third platoons will have their on-tank training in coming IDTs. This weekend, they are training both gunnery and maneuver tables. Saturday morning, all the drivers and loaders gather on 4 Abrams Trainers for Driver Matrix Training with the Company XO. At the same time the TCs and Gunners train gunnery table VIII (Tank) then table XII (Platoon Gunnery) working with the Company Master Gunner. The Company Commander is using the 2 headquarters tanks to coach two new TCs using the tank commander training matrix of the Abrams Trainer. That afternoon, the Platoon Leaders take over the Trainers for their Platoons and conduct the Coordination level Tactical Tables on Hasty Attack. They make three runs each including AARs.

That night, the tone of training turns to competitive proficiency training. The Company Commander will continue the Table VIII competition that had started the previous IDT. The Gunnery Matrix in the Abrams Trainer has a competition class set of very difficult multiple simultaneous engagements. Battalion has authorized a $1,000 cash award and special patch for the Top Gun crew in each Company. There is a similar Leader Competition open to Platoon Leaders who have to fight common Platoon Reaction Tables across the Battalion. That competition will not start until next month and the chain of command encourages Platoon Leader practice during the week using one of the Abrams Trainers left in each Armory and the SAFOR (constructive simulation) which has been set up to support the Table. Nevertheless, two of the Platoon Leaders want to try it in advance so they can talk the table over with their TCs. The AAR will automatically assess their

performance and each Platoon Leader feels that talking this over with their leaders will be a good way to develop Platoon spirit and teamwork. The Platoon Leaders had been exposed to this type competition in AOBC and felt quite confident they would demonstrate competence not incompetence to their TCs. Anyway, both had practiced once already off line just themselves with everybody else automated at the Armory one afternoon after work.

The next morning, the Company Commander turned up the heat. Each platoon was given three Platoon Tables--two Tactical Action and one Platoon Reaction in succession--Movement to Contact, Hasty Defense, then Retrograde. The Company Commander alternates between platoons in conducting the AAR. Finally, the leaders turn over their units to the First Sergeant and the Platoon Sergeants and the weekend training is completed with a Fire Coordination Exercise conducted by the Company Commander, the FIST and the Platoon Leaders. They fight from their Abrams Trainers with all other friendly and enemy forces represented by SAFOR (constructive simulation). The Battalion S3 and Fire Support Officer monitor and conduct the AAR netted to the virtual battlefield from the Battalion Headquarters Armory located about 150 miles away.

All this is, of course, speculative, although everything proposed has been done manually in piece part during the past several years. Some of the training and technology development to permit distribution to standard will materialize, some will not. However, the magnitude of the potential change in training programs should be apparent. During this MUTA 4, this hypothetical unit will have have had one platoon continuously on-equipment training in tactical tables. Each of the other two platoons will have executed 20 to 30 repetitions of tank and platoon gunnery tables, 6 platoon tactical tables, several mastery level gunnery and tactical lanes and several Fire Coordination Exercises. In one MUTA 4, this Tank Company will have had more combat training--quantitative as well as qualitative--than the average unit experiences today in a week of AT. And that is the objective: to develop and design a new simulation-based intensified training readiness strategy for the Reserve Component intended to create an order of magnitude improvement in the effectiveness and efficiency of Reserve Forces training.

ENCLOSURE D

EVALUATION

ENCLOSURE D
EVALUATION

Evaluation of product should be an integral part of any development program. That is particularly so with a program of this nature relying as it does on interactive development of new training matched with new technology all of which must come together consistently in hundreds of dispersed locations to achieve promised results. It is a problem of application, of execution, almost as much as it is one of development. Two chapters specifically address this challenge. Chapter V, Executing the Vision, describes a soldier-oriented action program to focus coordinated integrated development and subsequent evaluation across the National Guard. Six levering program areas were selected and an appropriate development schedule laid out. In addition, a tentative schedule for confirming "trials" was described at page V-11. This organization is proposed to orchestrate the very considerable training development required from the uniformed military--both Guard and TRADOC proponents.

Then in Chapter VI, Technology Teaming, technology needs developed in this study were related to the DARPA Requirements Development Tasks, and five integrating technology teams were proposed composed of DARPA/NGB program management, Guard soldiers, and scientists. The five teams focus on: a new generation of simulation/ simulators; low-cost high-resolution instrumentation of equipment; expanded behavior representation; "kitchen table" networking; and quick response graphics. Each development should have its own evaluation plan; however, piece part tests of various "eaches" will not assess the whole which far exceeds the sum of the parts. There need to be frequent "full up" Proofs of Principle.

The rather complex overall organization and teaming has been proposed to address the "whole"--to bring the training development together with critical technology development in an organizational framework chartered to stimulate frequent Proofs of Principle as the various developments are being merged. These processes are the essence of mission accomplishment and therefore the foci of intense evaluation. Proofs of Principle should result in virtually continuous evaluation which is essential in a complex development project of this magnitude. That is the major component of the evaluation plan.

What is envisaged is an interactive process of continuing evaluation, essentially test, fix, test with Training Effectiveness Analyses. This evaluation process should be structured and monitored by a respected external organization such as the Army Research Institute or comparable organization chartered to counsel in both the overall development decision process, the deliberations of the various working groups and most critically in the design and execution of the various Training Effectiveness Analyses. For example, evaluation personnel should be present in the technology integrating teams suggested above. This extensive evaluation effort should be focused on two separate but related issues. First, is the desired training readiness benefit being achieved by the typical reserve unit for which it is designed? Second, is the complex DARPA/NG program designed to bring together many complex requirements in fact achieving its development goals. If not, why not?

All evaluations should be sensitive to the following:

- Does the combination of training and technology developed achieve the order of magnitude improvement desired? This assessment has to be made of each major module--the devices such as the Abrams or Bradley Trainer, the Instrumented Abrams and the Command-Staff Trainer, both stand-alone and in conjunction with the associated training exercise such as the tactical table or the on terrain structured exercise. Hardware, software in support of the training and the sequencing of the training all need to be evaluated. All need to be validated with typical individuals or units according to the projected use for small unit, leader or battle command/staff training. Each evaluation should be sensitive to the detailed front end analysis which should have preceded the technology development. What are the skills and competencies to be acquired by the units; then what are the objective tasks and standards? Is the derived device/simulator effective in dollar and manpower cost and most critically in time of the soldier? In sum, the training objectives must be laid out in precise detail, then the development process evaluated at every step to ensure that the desired objectives are in fact being achieved.
- Is there adequate evaluation built into the strategy? Evaluation is not only a critical tool in control of the development process, it is also the "heart and soul" of the process of effective training to standard. All training should be evaluation; all evaluation should be training. The objective training strategy should facilitate continuing evaluation of the effectiveness of the training by the unit chain of command. The design of the tables to facilitate after action reviews is intended to enhance unit internal evaluation. "Use Drills and Tables to Train Basics," pp. II-16 ff, addresses this. Any data collection should be virtually invisible to the individuals in training but readily available so that the

trainer can assess results immediately after training. External evaluation is equally important. The objective training strategy should support independent external evaluation at minimum disruption to the reserve unit. The rigor provided by the "frozen" METT-T characteristic of the extensive table exercises supports external evaluation as do the pre-established Measures of Performance and Measures of Effectiveness embedded in the AARs. The overall program evaluation effort needs to place particular emphasis on assessing the adequacy of the intensive training strategy in ensuring effective internal and external evaluation within the unit.

- As the exercise and device come together in the home, armory, WET site, etc., does the training program cause the desired training to occur? Here the concern is the training effectiveness of the program as it is presented to the distributed target audience in the typical competency and confusion of the small unit. Some exercises may be excellent when undertaken in a structured large or small group mode, but without growth potential to present in the home or work place with average people of average motivation.
- Is the technology sufficiently robust that it can be operated in a range of training environments from armory to field assembly area by trained Guardsmen without major maintenance problems?

Execution of the evaluation effort should be guided by several additional guidelines:

- FORSCOM supported by TRADOC is embarked on an extensive RC Enhancement Action Plan--Bold Shift--to improve Guard training, particularly in the Roundout Brigades. The Armor Center has completed the front end analysis for a trial intensive training program for Armor units starting in FY 92 (Infantry Center also for Mechanized Infantry). The proposed strategy is absolutely consistent with what is proposed in this study. Evaluation of that effort should be closely monitored.
- The assessment Measures of Training Performance should be baselined on CTC, Persian Gulf, or Panama missions and training Lessons Learned so comparative use can be made of the extensive training data base. The Desert Storm Lessons Learned should be completed in early FY 92. They should be incorporated as appropriate.
- The assessments should be both performance- and attitude-based. Where possible assess pre- and post-training proficiency by actual performance. Supplement this with attitude surveys of participants and training support overhead.

Finally, there is a very considerable coordinating effort required to effect the evaluations discussed above. Pages VI-3 ff lay out initial guidance for the proposed Technology

Teams including appropriate conceptual guidance, milestones, and a tentative schedule of trials assuming that the entire program proposed in this study is initiated. As soon as a precise DARPA/National Guard program is initiated, Trials--Proofs of Principle--Training Effectiveness Analyses, should be planned incorporating the guidelines discussed above.

ENCLOSURE E

POST MOBILIZATION TRAINING

ENCLOSURE E
POST MOBILIZATION TRAINING

Routinized peacetime reserve training to necessary levels of training proficiency is important. It is a major determinant of our national military capability. There are two major elements to any reserve forces training strategy. They are the pre-mobilization training which is the primary focus of this study and the post-mobilization training which completes the training required prior to deployment to battle. Post-mobilization training is absolutely vital for that is what determines the actual warfighting readiness of the force. There will be two broad categories of units undergoing post-mobilization training. They are constituted units which need to complete their unit training prior to deployment and additional units to be formed from scratch after mobilization. These latter units will require structured individual and unit training similar to that executed in peacetime with active component units. The training infrastructure should be present for this training; it is largely "more of the same." The challenge will be the accelerated completion of the mission training for constituted units about to deploy.

The purpose of this Enclosure is to assess the appropriateness of the study, a proposed simulation-based intensified training strategy, for post-mobilization training of constituted units facing a deadline of deployability schedules. The draft strategy described follows very closely the actual post-mobilization training strategy employed by the Total Force with the National Guard Round Out Brigades mobilized for Desert Shield, but with the addition of specific understood post-mobilization training objectives established well before mobilization. The Desert Shield strategy consisted of structured multi-echelon training conducted by the chain of command which was supported by non-deploying Active Component units which replaced the deployed AC Divisions as training "mentors." The intensive training was conducted at the National Training Center and Fort Hood. Subsequent extensive After Action Reviews of Desert Shield RC maneuver brigade training have resulted in an aggressive Total Force training enhancement program intended to commence in FY92-FORSCOM Operation Bold Shift. The comprehensive program, supported by appropriate training development, addresses both pre- and post-mobilization training. It includes the following in execution of FM 25-101:

- Structured multi-echelon training
- Training and evaluation to prescribed tasks not trained pre-mobilization
- Chain-of-command responsibility for the conduct of the training.

This near-term FORSCOM action program will be executed as the policies and programs of the long-term DARPA/NG pre- and post-mobilization intensified training strategy are being developed in detail and evaluated. Both efforts are absolutely complementary today; they have been developed in close coordination during the period July-October 1991.[1] They should continue to be mutually supporting as additional post-mobilization policies and programs are developed. The best assurance of relevence of the post-mobilization training strategy proposed in this study is continuing coordination with the FORSCOM and TRADOC efforts as they evolve.

The following assessment assumes that mobilization has occurred. The war is unfolding much as it did for Desert Shield but then mobilization continues from partial on into full then total mobilization. As contingency forces deploy, reserve forces move to mobilization stations for post-mobilization training. The subsistent, virtual, and constructive simulation available at armory and LTA pre-mobilization is available for distributed training prior to movement to the mobilization station and then moves to the mobilization station with the unit. Once there it can reinforce the existent training infrastructure of the mobilization station. Further, it seems reasonable to assume that Power Projection and Reconstitution combat units will go to facilities with at least MTA training facilities and probably RC BTC quality capability. With these assumptions, it is useful to review the four leverage areas Compression, Distribution, Modernization, and Prioritization:

Compression

Prior to movement to the mobilization station, if the unit has time to train despite the myriad of other activities required when the unit is federalized, the premob training support should still be present to enable continuing distributed training. At this stage the training would probably be individual and squad or crew training as deployability criteria change

---

1 The Armor Center has extended the near-term Bold Shift to a longer term program--Action Plan Bold Thrust FY 93-98. This program incorporates mission analysis, a training strategy and training programs structured to provide STX lane training and tactical tables, as well as a Junior Leader Battle Proficiency Course. The mission analysis prescribes missions, collective tasks, and individual tasks for both pre- and post-mobilization training. USAARMC, *Bold Shift, Bold Thrust Information Briefing*, October 1991.

battle rosters, but basically there should be few unanticipated requirements at this stage of deployment. If possible, it would be very helpful to retrain all of the tables to the basic level so that expert level training can start at the mobilization station. Many of the conditions of expert level are already present in the tables as the Reaction Tables, so some units may be able to shift to that level while still at the armory, in anticipation of deployment.

More substantive changes come when the unit arrives at the mobilization station:

- New personnel arrive to fill out the unit. Additional crew and small unit exercises will be required to accelerate the training and bonding process. The inherent design flexibility of the tables and STX to the "what if" changes will permit modifications to the tables to intensify bonding during the post mobilization training.
- There are many more opportunities for on-the-ground, on-equipment training at the mobilization station. The unit will probably move to the field and begin intensive structured lane training. The events will be very familiar to those already in the unit training program but a much higher percentage of tables and STX will be on the terrain, live fire. Then, higher echelon Field Training Exercises will be added to battalion and brigade echelons. Battle command/ staff training will make a similar transition from virtual and constructive simulation to on-the-ground STX and FTX requiring full command staff action. Vertical and constructive simulation can still make a major contribution both immediately before or during field tactical training. Simulation "warm up" before field execution or simulation "reruns" while other units are using the on-the-ground structured lanes are examples. Leader training exercises pre-mobilization will continue post-mobilization for individual leader training. They will probably stay with the heavy diet of simulation because of the need to conserve training resources for deploying units.

On balance, the deploying unit will find that the compression techniques and training support of premobilization change very little on mobilization. Training strategies are virtually identical although additional compression may be possible through innovative sequencing of simulation and on terrain training.

Distribution

Here problems should decrease as distribution is reduced. As units converge on the mobilization station, there will be potential to apply the newly available networking resources to tie the units in training to units already deployed for potential exchange of Lessons Learned. It may be possible to begin vertical bonding into the various battlefield

operating system networks in the operational theater of operations to reduce the familiarization time when the unit arrives in theater. For example, intelligence units could tie to the operating IEW network while still in the mobilization station.

Modernization

Most of the training infrastructure should be as useful post-mobilization as pre-mobilization. Equipment--Abrams/Bradley Trainers--could be modified to reflect new capabilities such as new ammunition revealed only after the start of hostilities. The OPFOR would have to be modified to reflect the doctrine, tactics, and equipment of the actual enemy and the terrain of the theater of operations added to the terrain data base, but these are only issues of prewar planning. No challenge to the basic training strategy and nothing that technology could not correct rapidly.

Prioritization

The pre-mobilization strategy assumed selection of the most important tasks for training. Presumably there will be changes after war starts as a task analysis is accomplished of the contingency area of operations. For example, breaching operations became much more important after the initiation of Desert Shield. The design of the training strategy and infrastructure will permit modular insertion of new tasks into tables or STX.

The post-mobilization training readiness impact of the four leverage areas discussed above will be influenced by the effectiveness, or absence thereof, of application of the peacetime training conceptual directions to the post-mobilization training environment. In general, there appears to be a high degree of transferability of the concepts embedded in the intensive training strategy:

- *Immersion in warfighting:* This should be enhanced by assembling both unit and training support in a structured training environment at the mobilization station. Most of the obstacles to intense immersion training should have disappeared when the unit concentrated in a focused training environment.
- *Train in unit context with complementarity of training on actual equipment and in simulation:* Provided by virtue of the design of the post-mobilization training environment.
- *Shift the loci of training:* Distributed communications would be exploited to permit staff coordination as well as some training by leaders prior to movement

to the mobilization station. Not applicable once the unit assembles at the mobilization station.

- *Train the unit to train (decentralized) while training its leaders (centralized) in the school:* Not applicable post mobilization. Presumably the unit chain of command will be present in the unit to conduct the training.
- *Encourage local "what ifs:"* Prior to mobilization the "what if" is encouraged to stimulate local unit interest and initiative. Once mobilization occurs, there should be a contingency METT-T to focus the conditions of training. Now the "what if" is encouraged to stimulate unit initiative in train up for likely battlefield situations. There may also be applications in COHORT-style bonding training for newly assigned personnel.
- *Chain of command not Observer/Controller training:* This is precisely how the unit will train post mobilization per Army training doctrine. Some support may be present to facilitate the training, such as providing range guards and other administrative support. The substantive training is the responsibility of the unit chain of command.
- *Use Drills and Tables to train basics:* Drills and Tables should be equally applicable for initial post-mobilization collective unit training, particularly as individual replacements come to the unit. However, the unit should transition rapidly to advanced Tables and STX oriented to the actual contingency Mission Essential Task List.
- *Design training to encourage competition:* Not applicable for constituted units after mobilization. The motivation is imminent combat.
- *Encourage supportive unit policies:* The issue is to encourage unit focus on demanding training. After mobilization, mobilization station policies should be designed to facilitate intensive training by relieving the unit of as many administrative "non-combat" responsibilities as possible.
- *Distribute training to the lowest feasible echelon:* Not applicable post mobilization. The unit will be assembled presumably with the chain of command at least to Brigade echelon.
- *Incorporate low cost consumer electronics:* Applicable only in that earlier development of low cost training support should have assured sufficient quantity so there is a plentiful supply post mobilization.
- *Develop flexibility of echelon, locale, means and application:* Flexibility will be essential to adjust to the predictable "unexpected" requirements which arise during contingency combat operations.

- *Improve the resolution of virtual realities:* Lower cost part task trainers tuned to minimum necessary resolution will provide more training support available for both constituted and newly formed unit training.
- *Provide improved networked simulators (freestanding and appended to actual equipment):* Equally applicable both pre and post mobilization.
- *Create new training exercises:* Exercises created for peacetime training provide the springboard for post-mobilization training. The pre-mobilization exercises are focused on training to basic levels of proficiency although some very high priority early deploying units may need to train at the expert level. More exercises will be required to be developed to train to expert levels of proficiency and to focus on specific METT-T of the contingency area.
- *Train "levering" battle tasks:* Absolutely vital that post mobilization training be to the METT-T of the contingency area.
- *Institutional training priority for leader training:* Applicable both pre and post mobilization.

There appears to be little difficulty shifting the training strategy from pre to post mobilization since the focus of immersion in warfighting remains constant and concentration of resources permitted by mobilization in fact simplifies the training challenge. These attributes should apply equally to full and total mobilization. Whether leader, small unit or battle command/staff training, the strategy and infrastructure sufficient for distributed peacetime training should suffice. More training support would have to be produced but the orientation on consumer electronics should ensure full produceability. Execution of the strategy is designed for a chain of command that is learning "as it goes." The technology permits ready modification of task condition or standard to changing METT-T. The strategy appears fully adaptable to mobilization training.

Some changes would be required in the design of the specific programs. As discussed above in the assessment by conceptual area, competition could be reduced. Fewer "what ifs" should be necessary to stimulate interest. The necessity to train constituted units to the expert level as newly formed units are training to the basic level may require changes to some training software. But these all seem minor. Other problems may be more substantive reflecting training development requirements which are beyond the scope of this current analytical effort. Some new challenges may be:

- IRR personnel will have to be integrated into deploying units and other IRR integrated into newly created units or provided refresher training prior to deployment as individual replacements. New training may be required to more

rapidly refresh then bond into new units. There is some experience in COHORT training strategies which may prove useful.

- Some units may find that they will be drawing new equipment in theater. M1A1 issue during Desert Shield is a case in point. There may be new equipment training requirements which could mandate accelerated new equipment training as a part of mobilization.
- Combat units need sustainment training after they have shipped their equipment by sea while they are awaiting air shipment training. There may be competition for some of the training support previously assigned to active component units.
- Cadre units may require new training packages after their individual soldiers have been assigned. This would appear to be a requirement comparable to the COHORT type challenge described above. The proposed training strategy is structured for crawl, walk, run in a prescribed series of tasks with explicit measures of performance. It is amenable to simulation or on terrain training. It would appear to have sufficient flexibility to handle any cadre training challenge but this should be assessed by evaluation.

In sum, assessment of the relevance of the proposed strategy to post-mobilization training is favorable. The major constraints which governed the peacetime strategy--shortage of time with people and funding much less constrained--also prevail after mobilization. As we have seen, there are new circumstances which will require timely modifications to the training strategy. Basically, a strategy designed primarily to increase dramatically the effectiveness and efficiency of the training process when time is the critical resource prewar applies equally well when time is limited to generate deployable forces after mobilization.

The strategy should work. After all, it is based on immersion in warfighting--fighting a continuing battle. Because we train as we fight and our training assumes continuing battle, the transition to actual operations only involves changing METT-T to those of the objective theater of operations and transition to live ammunition against a live enemy. For these reasons, the proposed intensified training strategy seems applicable whether we are describing Power Projection or Reconstitution Forces across the range of requirements from partial to full to total mobilization. However, the issue is so important to national security that it should be subject to extensive evaluation. Training Effectiveness Analyses should be conducted of post-mobilization training strategies for both constituted and post-mobilization newly formed units.

ENCLOSURE F
ABSTRACT FROM
IDA STATEMENT OF WORK

28 Mar 91

"1. . . . perform the following service:

a. Develop and design a new simulation-based intensified training readiness strategy for the Reserve Component intended to create an order of magnitude improvement in the effectiveness and efficiency of Reserve Forces training.

b. The strategy should be focused initially on individual to company team unit training and leader training. The strategy should be compatible with the later development of battle command training for battalions and above, which is being worked separately.

c. The strategy must be complementary to the OSD Total Force Policy Study and to IDA's concept and design of models and simulations to support service and joint training in the Southwest United States. Examine and recommend core simulation technology development requirements to support the proposed RC strategy.

d. The design should be packaged for evaluation in a multi-year DARPA/Army National Guard unit testbed.

2. Focus initially on Army Reserve Component (RC) Forces initially but ensure that the design can accommodate subsequently (1) USN and USMC reserves and (2) USAF reserves. The readiness strategy should be appropriate for combat (must), combat support (desired), and combat service support (desired) units at the battalion and brigade or equivalent echelons. There should be growth potential for extension of the training readiness strategy to division/COSCOM echelon and to Force Reconstitution although that extension is not included within this task. It must be compatible with established long-term readiness programs of National Guard and Reserve units in a combination of institutional and unit individual and collective home station and annual training.

3. The task is in the nature of long-range planning. It is not intended to be immediate, current operations, reaction to ongoing actions in Southwest Asia or current operations at the National Training Center. The objective strategy should, however, address agreed training readiness deficiencies. Similarly the strategy must be suitable for translation into specific policies and implementing programs although that planning detail is not part of this task. . . ."

ENCLOSURE F

ABSTRACT FROM
IDA STATEMENT OF WORK